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HAZEN'S
PANORAMA
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MORTON DEL
R.S. GILBERT SC.

Phoenix Society Library.

THE
PANORAMA
OF
PROFESSIONS AND TRADES;
OR
EVERY MAN'S BOOK.

BY EDWARD HAZEN.

EMBELLISHED WITH EIGHTY-TWO ENGRAVINGS.

PHILADELPHIA:
PUBLISHED BY URIAH HUNT.
SOLD BY THE BOOKSELLERS GENERALLY.

1836.

STEREOTYPED

ENTERED

ACCORDING TO THE ACT OF CONGRESS

IN THE YEAR

1836,

BY EDWARD HAZEN

IN THE

CLERK'S OFFICE OF THE DISTRICT COURT

OF

THE EASTERN DISTRICT OF

PENNSYLVANIA.

BY JOHN FAGAN.

PHILADELPHIA,

1836.

Printed by
T. K. & P. G. COLLINS,
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PREFACE.

1. THE following work has been written for the use of Schools and Families, as well as for miscellaneous readers. It embraces a class of subjects in which every individual is deeply interested, and with which, as a mere philosophical inspector of the affairs of men, he should become acquainted.

2. They, however, challenge attention by considerations of greater moment than mere curiosity: for, in the present age, a great proportion of mankind pursue some kind of business as means of subsistence or distinction; and, in this country especially, such pursuit is deemed honourable, and, in fact, indispensable to a reputable position in the community.

3. Nevertheless, it is a fact that cannot have escaped the attention of persons of observation, that many individuals mistake their appropriate calling, and engage in employments for which they have neither mental nor physical adaptation: some learn a trade, who should have studied a profession; others study a profession who should have learned a trade. Hence arise, in a great measure, t

ill success, and discontent which so frequently attend the pursuits of men.

4. For these reasons, parents should be particularly cautious in the choice of permanent employments for their children; and, in every case, capacity should be especially regarded, without paying much attention to the comparative favour in which the several employments may be held; for, a successful prosecution of an humble business is far more honourable than inferiority or a failure in one which may be greatly esteemed.

5. To determine the particular genius of children, parents should give them, at least, a superficial knowledge of the several trades and professions. To do this effectually, a systematic course of instruction should be given not only at the family fireside and in the school-room, but also at places where practical exhibitions of the several employments may be seen. These means, together with a competent literary education and some tools and other facilities for mechanical operations, can scarcely fail of furnishing clear indications of intellectual bias.

6. The course just proposed is not only necessary to a judicious choice of a trade or profession, but also as means of intellectual improvement:
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though the choice of
ere not in view.
ved with a nature composed of many faculties both of the intellectual and the animal kinds, and the reasoning faculties were originally designed by the creator to have the ascendency. In the present moral condition of man, however, they do not commonly maintain their right of precedence. This failure arises from imbecility, originating, in part, from a deficiency in judicious cultivation, and from the superior strength of the passions.

8. This condition is particularly conspicuous in youth, and shows itself in disobedience to parents, and in various other aberrations from moral duty. If, therefore, parents would have their children act a reasonable part, while in their minority, and, also, after they have assumed their stations in manhood, they must pursue a course of early instruction calculated to secure the ascendency of the reasoning faculties.

9. The subjects for instruction best adapted to the cultivation of the young mind are the *common things* with which we are surrounded. This is evident from the fact, that it uniformly expands with great rapidity under their influence during the three or four first years of life: for it is from them, children obtain all their ideas, as well as a knowledge of the language by which they are expressed.

10. The rapid progress of young children in the acquisition of knowledge often excites the surprise of pa-

rents of observation, and the fact that their improvement is almost imperceptible after they have attained to the age of four or five years is equally surprising. Why, it is often asked, do not children continue to advance in knowledge with equal and increased rapidity, especially, as their capabilities increase with age?

11. The solution of this question is not difficult. Children continue to improve, while they have the means of doing so; but having acquired a knowledge of the objects within their reach, at least, so far as they may be capable at the time, their advancement must consequently cease. It is hardly necessary to remark, that the march of mind might be continued with increased celerity, were new objects or subjects continually presented.

12. In supplying subjects for mental improvement, as they may be needed at the several stages of advancement, there can be but little difficulty; since we are surrounded by works both of nature and of art. In fact, the same subjects may be presented several times, and, at each presentation, instructions might be given adapted to the particular state of improvement in the pupil.

13. Instructions of this nature need never interfere injuriously with those on the elementary branches of education; although the latter would undoubtedly be considered of minor importance. Had they been always regarded in this light, our schools would now present a far more favourable aspect, and we should have been farther removed from the ignorance and the barbarism of the middle ages.

14. Were this view of education generally adopted, teachers would soon find, that the business of communicating instructions to the young has been changed from an irksome to a pleasant task; since their pupils will have become studious and intellectual, and consequently more capable of comprehending explanations upon every subject. Such a course would also be attended with the incidental advantage of good conduct on the part of pupils, inasmuch as the elevation of the understanding over the passions uniformly tends to this result.

15. For carrying into practice a system of intellectual education, the following work supplies as great an amount of materials as can be embodied in the same compass. Every article may be made the foundation of one lecture or more, which might have reference not only to the particular subject on which it treats, but also to the meaning and application of the words.

14. The articles have been concisely written, as must necessarily be the case in all works embracing so great a variety of subjects. This p ticular trait, however, need not considered objectionable, si

who may desire to read more extensively on any particular subject, can easily obtain works which are exclusively devoted to it.

17. Prolix descriptions of machinery and of mechanical operations have been studiously avoided; for, it has been presumed, that all who might have perseverance enough to read such details, would feel curiosity sufficient to visit the shops and manufactories, and see the machines and operations themselves. Nevertheless, enough has been said, in all cases, to give a general idea of the business, and to guide in the researches of those who may wish to obtain information by the impressive method of actual inspection.

18. A great proportion of the whole work is occupied in recounting historical facts, connected with the invention and progress of the arts. The author was induced to pay especial attention to this branch of history, from the consideration, that it furnishes very clear indications of the real state of society in past ages, as well as at the present time; and also that it would supply the reader with data, by which he might, in some measure, determine the vast capabilities of man.

19. This kind of historical information will be especially beneficial to the youthful mind, by inducing a habit of investigation and antiquarian research. In addition to this, a knowledge of the origin and progress of the various employments which are in active operation all around, will throw upon the busy world an aspect exceedingly interesting.

20. It may be well, however, to caution the reader against expecting too much information of this kind, in regard to most of the trades practised in very ancient times. Many of the most useful inventions were effected before any permanent means of record had been devised; and, in after ages, among the Greeks and Romans, the useful arts were practised almost exclusively by slaves. The latter circumstance led to their general neglect by the writers among these distinguished people

21. The information which may be obtained from this work, especially when accompanied by the inspection of the operations which it describes, may be daily applied to some useful purpose. It will be particularly valuable in furnishing subjects for conversation, and in preventing the mind from continuing in, or from sinking into, a state of idle indifference in regard to the busy scenes of this world.

22. In the composition of "The Panorama of Professions and Trades," all puerile expressions have been avoided, not only because they would be offensive to adult individuals of taste, but because they are at least useless, if not positively injurious, to younger persons. What parent of

reflection would suffer his children to peruse a book calculated to induce or confirm a manner of speaking or writing, which he would not have them use after having arrived to manhood? Every sentence may be rendered perfectly plain by appropriate explanations and illustrations.

23. No formal classification of the professions and trades has been adopted, although those articles which treat of kindred subjects have been placed near each other, and in that order which seemed to be the most natural. The paragraphs of the several articles have been numbered for the especial accommodation of classes in schools: but this particular feature of the work need meet with no serious objection from miscellaneous readers, as it has no other effect, in reference to its use by them, than to give it the aspect of a school-book.

24. While writing the articles on the different subjects, the author consulted several works which embraced the arts and sciences generally, as well as many which were more circumscribed in their objects. He, however, relied more upon them for historical facts than for a knowledge of the operations and processes which he had occasion to detail. For this he depended, as far as practicable, upon his own personal researches, although in the employment of appropriate phraseology, he acknowledges his obligations to predecessors.

25. In the embellishment of "The Panorama," great expenses have been incurred. The first title-page and the representation at the commencement of each article were designed expressly for the work. The designs were made by Messrs. Morton, Hoyle, Burton, and Gimber, of New-York; and nearly the whole of the engraving was executed by Mr. A. J. Mason, of the same city, but lately from London. The first title, the cut representing some of the operations of the manufacturer, and the illustrations of architecture and of optics, were engraved by R. S. Gilbert, of Philadelphia.

26. Near the close of the volume is a copious set of questions upon the articles which precede; and these are numbered according to the paragraphs to which they refer. It is recommended to parents and teachers, to use not only these, but also many more, which they can easily construct extemporally.

27. The author cannot well close his preface without again recommending to parents the practice of teaching their children, not only when the latter are deprived of the advantages of school instructions, but even when they enjoy the best privileges of this kind. The necessity of performing this duty is evident from what has been already said: but an additional argument in its fa
may be derived from the ci
stance, that the prevailing

of education is not sufficiently intellectual.

28. Many parents see the necessity of domestic instructions; but they commonly fancy that they have discharged their obligations by hearing their children read and spell a little. Some interpose their authority so far as to compel their children to commit to memory the tasks imposed by the teachers, and, to determine the fact of the committal, go through the irksome task of hearing the recitations.

29. These efforts are certainly commendable, and ought not to be discouraged; but they do not embrace the kind of instructions which the author is particularly urgent in recommending. He verily believes that more efficient aid can be afforded to the intellect in one hour, when *common things* are the subjects of instruction, than by a month's severe discipline in the course just alluded to.

30. The objection most commonly urged to the performance of the duty proposed, is, "We have not time." To this it may be answered: parents have time enough to provide food and raiment, as well as every other means to supply the wants of the animal nature of their children; and if they would estimate, with any degree of exactness, their intellectual necessities, no such objection would be made, especially by those who feel the influence of moral obligation.

31. But the most formidable objection is this: "We are incapable of executing a task so difficult, teaching not being our business." To this it may be answered: the difficulty is much overrated. Any individual with a moderate share of intelligence, and some reading, can name the materials of the furniture of his house, and describe the process by which each article has been manufactured. After having done this, he can easily extend his instructions upon other subjects of a similar nature.

32. A systematic course of instruction, conducted on the principles proposed, would be attended with nothing irksome or disagreeable. On the contrary, it would add much interest to the social intercourse between parents and children; and the former would soon discover in the latter a great increase of intellectual strength, which would display itself in an improved expression of countenance, as well as in a more rapid progress in their regular studies at school.

33. With the preceding remarks, the author submits his work to the public, in the confident expectation, that the subjects which it embraces, that the care which has been taken in its composition, and that the skill of the artists employed in its embellishment, will secure to it an abundant and liberal patronage.

THE AGRICULTURIST.

1. AGRICULTURE embraces, in its broad signification, whatever relates to the cultivation of the fields, with the view of producing food for man, and those animals which he may have brought into a state of domestication.

2. If we carry our observations so far back as to reach the antediluvian history of the earth, we shall find, from the authority of scripture, that the cultivation of the soil was the first employment of man, after his expulsion from the garden of Eden, when he was commanded "to till the ground from which he had been taken." We shall also learn from the same source of information, that "Cain was a husbandman," and that "Abel was a keeper of sheep." Hence it may be inferred, that Adam instructed his sons in the art of husbandry; and that they, in turn, communicated this knowledge to *their* posterity, together with the superadded information which had resulted from their own experience. Improvement in this art was probably thenceforth progressive, until the overwhelming catastrophe of the flood.

3. After the waters had retired from the face of the earth, Noah resorted to husbandry, as the surest means of procuring the necessaries and comforts of life. The art of cultivating the soil, was uninterruptedly preserved in many branches of the great family of Noah; but, in others, it was, at length, entirely lost. In the latter case, the people, having sunk into a state of barbarism, depended for subsistence on the

natural productions of the earth, and on such animals as they could contrive to capture by hunting and fishing. Many of these degenerate tribes did not emerge from this condition for several succeeding ages.

4. Notwithstanding the great antiquity of agriculture, the husbandmen, for several centuries immediately succeeding the deluge, seem to have been but little acquainted with any proper method of restoring fertility to an exhausted soil; for we find them frequently changing their residence, as their flocks and herds required fresh pasturage, or as their tillage land became unproductive. As men, however, became more numerous, and as their flocks increased, this practice became inconvenient, and, in some cases, impracticable. They were, therefore, compelled, by degrees, to confine their flocks and herds, and their farming operations, to lands of more narrow and specified limits.

5. The Chaldeans were probably the people who first adopted the important measure, of retaining perpetual possession of the soil which they had cultivated; and, consequently, were among the first who became skilful in agriculture. But all the great nations of antiquity held this art in the highest estimation, and usually attributed its invention to superhuman agency. The Egyptians even worshipped the image of an ox, in gratitude for the services of that animal in the labours of the field.

6. The reader of ancient history can form some idea of the extent to which this art was cultivated in those days, from the warlike operations of different nations; for, from no other source could the great armies which were then brought into the field, have been supplied with the necessary provisions. The Greeks and the Romans, who were more celebrated than any other people for their military enterprise, were also most attentive to the proper cultivation of the soil; and many of their distinguished men, especially among the Romans, were practical husbandmen.

7. Nor was agriculture neglected by the learned men of antiquity. Several works on this subject, by Greek and Latin authors, have descended to our times; and the correctness of many of the principles which they inculcate, has been confirmed by modern experience.

8. Throughout the extensive empire of Rome, agriculture maintained a respectable standing, until the commencement of those formidable invasions of the northern hordes, which, finally, nearly extinguished the arts and sciences, in every part of Europe. During the long period of anarchy which succeeded the settlement of these barbarians in their newly-acquired possessions, pasturage was, in most cases, preferred to tillage, as being better suited to their state of civilization, and as affording facilities of removal, in cases of alarm from invading enemies. But when permanent governments were again established, and the people enjoyed comparative peace, the regular cultivation of the soil once more began to revive.

9. The art of husbandry was at a low ebb in England, until the fourteenth century, when it began to be practised with considerable success in the midland and south-western parts of the island: yet, it does not seem to have been cultivated as a science, until the latter end of the sixteenth century. The first book on husbandry, printed and published in the English language, appeared in 1534. It was written by Sir A. Fitzherbert, a judge of the Common Pleas, who had studied the laws of vegetation, and the nature of soils, with philosophical accuracy.

10. Very little improvement was made on the theory of this author, for upwards of a hundred years, when Sir Hugh Platt discovered and brought into use several kinds of manures for fertilizing and restoring exhausted soils.

11. Agriculture again received a new impulse, about the middle of the eighteenth century; and, in 1793, a Board of Agriculture was established by an act of Parliament, at the suggestion of Sir John Sinclair, who was elected its first president. Through the influence of this board, a great number of agricultural societies have been formed in the kingdom, and much valuable information on rural economy has been communicated to the public, through the medium of a voluminous periodical under its superintendence.

12. After the example of Great Britain, agricultural societies have been formed, and periodical journals published, in various parts of the continent of Europe, as well as in the United States. The principal publications devoted to this subject in this country, are the *American Farmer*, at Baltimore; the *New England Farmer*, at Boston; and the *Genesee Farmer*, at Rochester.

13. The modern improvements in husbandry consist, principally, in the proper application of manures, the mixture of different kinds of earths, the use of plaster and lime, the rotation of crops, adapting the crop to the soil, the introduction of new kinds of grain, roots, grasses, and fruits, as well as improvements in the breeds of domestic animals, and in the implements with which the various operations of the art are performed.

14. For many of the improved processes which relate to the amelioration of the soil, we are indebted to chemistry. Before this science was brought to the aid of the art, the cultivators of the soil were chiefly guided by the precept and example of their predecessors, which were often inapplicable. By the aid of chemical analysis, it is easy to discover the constituent parts of different soils; and, with this knowledge, there is but little difficulty in determining the best mode of improving them, or in applying the most suitable crops.

15. In the large extent of territory embraced within the United States, there is great variation of soil and climate; but in each state, or district, the attention of the cultivators is directed to the production of those articles which, under the circumstances, promise to be most profitable. In the northern portions of our country, the cultivators of the soil are called farmers. They direct their attention chiefly to the production of wheat, rye, corn, oats, barley, peas, beans, potatoes, pumpkins, and flax, together with grasses and fruits of various kinds. The same class of men in the southern states are usually denominated planters, who confine themselves principally to tobacco, rice, cotton, sugar-cane, or hemp. In some parts of that portion of our country, however, rye, wheat, oats, and sweet potatoes, are extensively cultivated; and, in almost every part, corn is a favourite article.

16. The process of cultivating most of the productions which have been mentioned, is nearly the same. In general, with the occasional exception of new lands, the plough is used to prepare the ground for the reception of the seed. Wheat, rye, barley, oats, peas, and the seeds of hemp and flax, are scattered with the hand of the husbandman, and are covered in the earth with the harrow. In Great Brit
such seeds are sown in drills; and t
method is thought to be better than

as it admits of the use of the hoe, while the vegetable is growing.

17. Corn, beans, potatoes, and pumpkins, are covered in the earth with the hoe. The ground is ploughed several times during the summer, to make it loose, and to keep down the weeds. The hoe is also used in accomplishing the same objects, and in depositing fresh earth around the growing vegetable.

18. When ripe, wheat, barley, oats, and peas, are cut down with the sickle, cradle, or scythe; while hemp and flax are pulled up by the roots. The seeds are separated from the other parts of the plants with the flail, or by means of horses or oxen driven round upon them. Of late, threshing machines are used to effect the same object. Chaff, and extraneous matters generally, are separated from the grain, or seeds, by means of a fanning-mill, or with a large fan made of the twigs of the willow. The same thing was formerly, and is yet, sometimes effected by the aid of a current of air.

19. When the corn, or maize, has become ripe, the ears, with the husks, and sometimes the stalks, are deposited in large heaps. To assist in stripping the husks from the ears, it is customary to call together the neighbours. In such cases, the owner of the corn provides for them a supper, together with some means of merriment and good cheer.

20. This custom is most prevalent, where the greater part of the labour is performed by slaves. The blacks, when assembled for a husking match, choose a captain, whose business it is to lead the song, while the rest join in chorus. Sometimes, they divide the corn, as nearly as possible, into two equal heaps, and apportion the hands accordingly, with a captain to each division. This is done to produce a contest for the most speedy execution of the task. Should the owner of the corn be sparing of his refreshments, his want of generosity is sure to be published, or sung, at every similar frolic in the neighbourhood.

21. Maize, or Indian corn, and potatoes of all kinds, were unknown in the eastern continent, until the discovery of America. Their origin is, therefore, known with certainty; but some of the other productions which have been mentioned, cannot be so satisfactorily traced. This is particularly the case with regard to those which have been extensively cultivated for many centuries.

22. The grasses have ever been valuable to man, as affording a supply of food for domestic animals. Many portions of our country are particularly adapted to grazing. Where this is the case, the farmers usually turn their attention to raising live stock, and to making butter and cheese. Grass reserved in meadows, as a supply of food for the winter, is cut at maturity with a scythe, dried in the sun, and stored in barns, or heaped in stacks.

23. Rice was first cultivated in the eastern parts of Asia, and, from the earliest ages, has been the principal article of food among the Chinese and Hindoos. To this grain may be attributed, in a great measure, the early civilization of those nations; and its adaptation to marshy grounds caused many districts to become populous, which would otherwise have remained irreclaimable and desolate.

24. Rice was long known in the east, before it was introduced into Egypt and Greece, whence it spread over Africa generally, and the southern parts of Europe. It is now cultivated in all the warm parts of the globe, chiefly on grounds subject to periodical inundations. The Chinese obtain two crops a year from the same ground,

and cultivate it in this way from generation to generation, without applying any manure, except the stubble of the preceding crop, and the mud deposited from the water overflowing it.

25. Soon after the waters of the inundation have retired, a spot is inclosed with an embankment, lightly ploughed and harrowed, and then sown very thickly with the grain. Immediately, a thin sheet of water is brought over it, either by a stream or some hydraulic machinery. When the plants have grown to the height of six or seven inches, they are transplanted in furrows, and again water is brought over them, and kept on, until the crop begins to ripen, when it is withheld.

26. The crop is cut with a sickle, threshed with a flail, or by the treading of cattle; and the husks, which adhere closely to the kernel, are beaten off in a stone mortar, or by passing the grain through a mill, similar to our corn-mills. The mode of cultivating rice, in any part of the world, varies but little from the foregoing process. The point which requires the greatest attention, is the keeping of the ground properly covered with water.

27. Rice was introduced into the Carolinas in 1697, where it is now produced in greater perfection than in any other country. The seeds are dropped along, from the small end of a gourd, into drills made with one corner of a hoe. The plants, when partly grown, are not transferred to another place, as in Asia, but are suffered to grow and ripen in the original drills. The crop is secured like wheat, and the husks are forced from the grain by a machine, which leaves the kernels more perfect than the methods adopted in other countries.

28. Cotton is cultivated in the East and West Indies, North and South America, Egypt, and in many other parts of the world, where the climate is sufficiently warm for the purpose. There are several species of this plant; of which three kinds are cultivated in the southern states of the Union—the *nankeen cotton*, the *green seed cotton*, and the *black seed*, or *sea island cotton*. The two first, which grow in the middle and upland countries, are denominated *short staple cotton*: the last is cultivated in the lower country, near the sea, and on the islands near the main land, and is of a fine quality, and of a long staple.

29. The plants are propagated annually from seeds, which are sown very thickly in ridges made with the plough, or hoe. After they have grown to the height of three or four inches, part of them are pulled up, in order that the rest, while coming to maturity, may stand about four inches apart. It is henceforth managed, until fully grown, like Indian corn.

30. The cotton is inclosed in pods, which open as fast as their contents become fit to be gathered. In Georgia, about eighty pounds of upland cotton can be gathered by a single hand, in a day; but in Alabama and Mississippi, where the plant thrives better, two hundred pounds are frequently collected in the same time.

31. The seeds adhere closely to the cotton, when picked from the pods; but they are properly separated by machines called gins; of which there are two kinds,—the roller-gin, and the saw-gin. The essential parts of the former are two cylinders, which are placed nearly in contact with each other. By their revolving motion, the cotton is drawn between them, while the size of the seeds prevents their passage. This machine, being of small siz is worked by hand.

32. The saw-gin is much larger, and moved by animal, steam, or water-pow-

It consists of a receiver, having one side covered with strong wires, placed in a parallel direction, about an eighth of an inch apart, and a number of circular saws, which revolve on a common axis. The saws pass between these wires, and entangle in their teeth the cotton, which is thereby drawn through the grating; while the seeds, from their size, are forced to remain on the other side.

33. Before the invention of the saw-gin, the seeds were separated from the upland cottons by hand,—a method so extremely tedious, that their cultivation was attended with but little profit to the planter. This machine was invented in Georgia, by Eli Whitney, of Massachusetts. It was undertaken at the request of several planters of the former state, and was there put in operation in 1792.

34. In the preceding year, the whole crop of cotton in the United States was only sixty-four bales; but, in 1834, it amounted to 1,000,617. The vast increase in the production of this article has arisen, in part, from the increased demand for it in Europe, and in the Northern States, but chiefly from the use of the invaluable machine just mentioned.

35. Sugar-cane was cultivated by the Chinese, at a very early period, probably two thousand years before it was known in Europe; but sugar, in a candied form, was used in small quantities by the Greeks and Romans, in the days of their prosperity. It was probably brought from Bengal, Siam, or some of the East India Islands, as it is supposed that it grew nowhere else at that time.

36. In the thirteenth century, soon after the merchants of the West began to traffic in Indian articles of commerce, the plant was introduced into Arabia Felix, and thence into Egypt, Nubia, Ethiopia, and Morocco. The Spaniards obtained it from the Moors, and, in the fifteenth century, introduced it into the Canary islands. It was brought to America and the West India Islands, by the Spaniards and Portuguese. It is now cultivated in the United States, below the thirty-first degree of latitude, and in the warm parts of the globe generally.

37. Previous to the year 1466, sugar was known in England chiefly as a medicine; and, although the sugar-cane was cultivated at that time in several places on the Mediterranean, it was not more extensively used on the continent. Now, in point of importance, it ranks next to wheat and rice in the vegetable world, and first in maritime commerce.

38. The cultivators of sugar-cane propagate the plant by means of cuttings from the lower end of the stalks, which are planted, in the spring or autumn, in drills, or in furrows formed by the plough. The new plants spring from the joints of the cuttings, and are fit to be gathered for use in eight, ten, twelve, or fourteen months. While growing, sugar-cane is managed much like Indian corn.

39. When ripe, the cane is cut and brought to the sugar-mill, where the juice is expressed between iron or stone cylinders, moved by steam, water, or animal power. The juice thus obtained is evaporated in large boilers, to a syrup, which is afterwards removed to coolers, where it is agitated with wooden instruments called *stirrers*. To accelerate its cooling, it is next poured into casks, and, when yet warm, is conveyed to barrels, placed in an upright position over a cistern, and pierced in the bottom in several places. The holes being partially stopped with canes, the part which still remains in the form of syrup, filters through them into the cistern beneath,

while the rest is left in the form of sugar, in the state called *muscovado*.

40. This sugar is of a yellow colour, being yet in a crude or raw state. It is further purified by various processes, such as re-dissolving it in water, and again boiling it with lime and bullocks' blood, or with animal charcoal, and passing the syrup through several canvas filters.

41. Loaf-sugar is manufactured by pouring the syrup, after it has been purified, and reduced to a certain thickness by evaporation, into unglazed earthen vessels of a conical shape. The cones have a hole at their apex, through which may filter the syrup which separates from the sugar above. Most of the sugar is imported in a raw or crude state, and is afterwards refined in the cities, in sugar-houses.

42. Molasses is far less free from extraneous substances than sugar, as it is nothing more than the drainings from the latter. Rum is distilled from inferior molasses, and other saccharine matter of the cane, which will answer for no other purpose.

43. Sugar is also manufactured from the sap of the sugar-maple, in considerable quantities, in the northern parts of the United States, and in the Canadas. The sap is obtained by cutting a notch, or boring a hole, in the tree, and applying a spout to conduct it to a receiver, which is either a rude trough or a cheap vessel made by a cooper. This operation is performed late in the winter, or early in the spring, when the weather is freezing at night, and thawing in the day.

44. The liquid in which the saccharine matter is suspended, is evaporated by heat, as in the case of the juice of the cane. During the process of evaporation, slices of pork are kept in the kettle, to prevent the sap, or syrup, from boiling over.

45. When a sufficient quantity of syrup, of a certain thickness, has been obtained, it is passed through a strainer, and, having been again placed over the fire, it is clarified with eggs and milk; the scum, as it rises, being carefully removed with a skimmer. When sufficiently reduced, it is usually poured into tin pans or basins, in which, as it cools, it consolidates into hard cakes of sugar.

46. Most of the lands in a state of nature, are covered with forest trees. This is especially the case in North America. When this division of our continent was first visited by Europeans, it was nearly one vast wilderness, throughout its entire extent; and even now, after a lapse of three centuries, a great portion of it remains in the same situation. The industrious settlers, however, are rapidly clearing away the natural encumbrances of the soil; and before a similar period shall have passed away, we may expect that civilized men will have occupied every portion of this vast territory which may be worthy of cultivation.

47. The mode of *clearing* land, as it is termed, varies in different parts of the United States. In Pennsylvania, and in neighbourhoods settled by people from that state, the large trees are deadened by girdling them, and the small ones, together with the underbrush, are felled and burned. This mode is very objectionable, for the reason, that the limbs on the standing trees, when they have become rotten, sometimes peril the lives of those that may be underneath. It seems, however, that those who pursue this method prefer risking life in this way, to wearing it out in wielding the axe, and in rolling logs.

48. A very different plan is pursue settlers from New-England. The ur brush is first cut down, and piled in he

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] black [illegible], which is [illegible] in large [illegible]. The [illegible] [illegible] black salts, which are converted into pot-ash, by [illegible] to the [illegible] [illegible] intense heat.

[illegible]. The process of making pearl-ash is the same, until the [illegible] has been reduced to black salts, [illegible] that no lime [illegible] [illegible]. The salts are [illegible] in large [illegible], heated by a blazing fire, which [illegible] [illegible] [illegible]. When sufficiently [illegible], the salts are dissolved in [illegible] water. The solution is allowed to [illegible], and all extraneous substances have [illegible] to the bottom, when it is drawn off, and evaporated to dryness. The residuum is [illegible] white salts. Another baking, like the former, completes the process.

[illegible]. Very few of the settlers have an ashery, as it is called, in which the whole process of making either pot or pearl-ash is performed. They usually sell the black salts to the store-keepers in their neighbourhood, who complete the process of the manufacture.

[illegible]. The trade in ashes is often profitable to the settlers: some of them even pay, in this way, the whole expense of clearing their land. Pot and pearl-ashes are packed in strong barrels, and sent to the cities; where, previous to sale, they are inspected, and branded according to their quality.

THE HORTICULTURIST.

1. The Creator of the Universe, having formed man from the dust of the ground, provided a magnificent garden for his residence, and commanded him "to dress it and keep it:" but, having transgressed the commandment of his lawful Sovereign, he was driven from this delightful paradise, thenceforth to gain a subsistence from the earth at large, which had been cursed with barrenness, thorns, thistles, and briars.

2. Scripture does not inform us, that Adam turned his attention to gardening; nor have we any means of determining the state of this art, in the centuries previous to the flood: but it is highly probable, that it had arrived to considerable perfection, before the approach of this destructive visitation from Heaven.

3. Gardens for useful purposes, were probably made soon after the waters had subsided; and the statement in Scripture, that "Noah planted a vineyard," may, perhaps, be regarded as evidence sufficient to establish it as a fact. If this were the case, the art, doubtless, continued progressive among those descendants of Noah, who did not sink into a state of barbarism after the confusion of tongues.

4. Among savage nations, one of the first indications of advancement towards a state of civilization, is the cultivation of a little spot of ground for raising vegetables; and the degree of refinement among the inhabitants of any country, may be determined, with tolerable certainty, by the taste and skill exhibited in their gardens.

5. Ornamental gardening is never tended to, in any country, until the art

general have advanced to a considerable degree of perfection; and it uniformly declines with other fine, or ornamental arts. Accordingly, we do not read of splendid gardens among the Babylonians, Egyptians, Jews, Greeks, Romans, and other nations of antiquity, until they had reached a very exalted state of refinement; and when these nations descended from this condition, or were overthrown by barbarians, this art declined or disappeared.

6. During the period of mental darkness, which prevailed between the eighth and thirteenth centuries, the practice of ornamental gardening had fallen into such general disuse, that it was confined exclusively to the monks. After this period, it began again to spread among the people generally. It revived in Italy, Germany, Holland, and France, long before any attention was paid to it in England.

7. In the latter country, but few culinary vegetables were consumed before the beginning of the sixteenth century, and most of these were brought from Holland; nor was gardening introduced there, as a source of profit, until about one hundred years after that period. Peaches, pears, plums, nectarines, apricots, grapes, cherries, strawberries, and melons, were luxuries but little enjoyed in England, until near the middle of the seventeenth century. The first *hot* and *ice-houses* known on the island, were built by Charles II., who ascended the British throne in 1660, and soon after introduced French gardening at Hampton-Court, Carlton, and Marlborough.

8. About the beginning of the eighteenth century, this art attracted the attention of some of the first characters in Great Britain, who gave it a new impulse in that ntry. But the style which they imita- was objectionable, on the ground, that the mode of laying out the gardens, planting and trimming the trees, was too formal and fantastical.

9. Several eminent writers, (among whom were Pope and Addison,) ridiculed this Dutch mode of gardening, as it was called, and endeavoured to introduce another, more consistent with genuine taste. Their views were, at length, seconded by practical horticulturists; and those principles of the art which they advocated, were adopted in every part of Great Britain. The English mode has been followed and emulated, by the refined nations of the eastern continent, and by many opulent individuals in the United States.

10. Since the beginning of the present century, horticultural societies have been formed in every kingdom of Europe. In Great Britain alone, there are no less than fifty; and, it is satisfactory to add, that there are also several of these institutions in the United States. The individuals who compose these societies, have for their objects, the collection and general dissemination of information on this interesting subject, with special reference to the introduction of new and valuable articles of cultivation.

11. The authors who have written upon scientific and practical gardening, at different periods, and in different countries, are very numerous. Among the ancient Greek writers, were Hesiod, Theophrastus, Xenophon, and Ælian: among the Latins, Varo was the first; to whom succeeded, Cato, Pliny the elder, Columella, and Palladius.

12. Since the revival of literature, horticulture, in common with agriculture, has shared largely in the labours of the learned; and many works, on this important branch of rural economy, have been published in every language of Europe. But

the publications, on this subject, which attract the greatest attention, are the periodicals under the superintendence of the great horticultural societies. Those of London and Paris, are particularly distinguished.

13. It is impossible to draw a distinct line between horticulture and agriculture, since so many articles of cultivation are common to both, and since a well regulated farm approaches very nearly to a garden.

14. The divisions of a complete garden, usually adopted by writers on this subject, are the following: 1st. the culinary garden; 2d. the flower garden; 3d. the orchard, embracing different kinds of fruits; 4th. the vineyard; 5th. the seminary, for raising seeds; 6th. the nursery, for raising trees to be transplanted; 7th. the botanical garden, for raising various kinds of plants; 8th. the arboretum of ornamental trees; and, 9th. the picturesque, or landscape garden. To become skilful in the management of even one or two of these branches, requires much attention; but to become proficient in all, would require years of the closest application.

15. In Europe, the professed gardeners constitute a large class of the population. They are employed, either in their own gardens, or in those of the wealthy, who engage them by the day, or year. There are some who devote their attention to this business, in this country; but these are chiefly from the other side of the Atlantic. In our Southern States, the rich assign one of their slaves to the garden.

16. Almost every family in the country and villages of the United States, has its little garden for the production of vegetables; in which are also usually reared, a few flowers, ornamental shrubs, and fruit trees: but horticulture, as a science, is studied and practised here by very few; especially that branch of it called picturesque, or landscape. To produce a pleasing effect, in a garden of this kind, from twenty to one hundred acres are necessary, according to the manner in which the ground may be situated. In an area of that extent, every branch of this pleasing art can be advantageously embraced.

17. Delicate exotic plants, which will not bear exposure to the open air during the winter, are preserved from the effects of the cold, in hot, or green-houses, which may be warmed by artificial heat. A hot house is exhibited in the representation of a garden, at the head of this article. It is composed chiefly of window-glass, set in sashes of wood. A green-house is usually larger; and is designed for the preservation of those plants requiring less heat.

18. The vegetables commonly cultivated in gardens for the table, are,—corn, potatoes, tomatoes, peas, beans, squashes, cucumbers, melons, strawberries, raspberries, blackberries, gooseberries, currants, beets, parsnips, carrots, onions, radishes, cabbages, asparagus, lettuce, grapes, and various kinds of fruits. The flowers, ornamental shrubs, and trees, are very numerous, and are becoming more so, by accessions from the forests and foreign countries.

19. The scientific horticulturist, in laying off his garden, endeavours to unite beauty and utility, locating the flowers, ornamental shrubs, and trees, where they will be most conspicuous; and those vegetables less pleasing to the eye, in more retired situations, yet in a soil and exposure adapted to their constitution. In improving the soil of his garden, he brings to his aid the science of chemistry, together with the experience of practical men. He is also careful in the choice of his fruit trees, and in increasing the variety of their products, by engrafting, and by inoculation.

THE MILLER.

1. The Miller belongs to that class of [illegible] which relate to the prepa[illegible] for man. The [illegible] in reducing the [illegible] to a suitable degree of [illegible].

2. The simplest method by which grain [illegible] or flour, is by [illegible] two stones [illegible] first [illegible] among some tribes of [illegible].

3. The first machine for comminuting [illegible] composed of a [illegible] position, [illegible] which was put in mo[illegible] means of a peg. This simple contrivance is still used in India, as well as in some sequestered parts of Scotland, and on many of the plantations in the Southern States of our Union. But in general, where large quantities of grain are to be ground, it has been entirely superseded by mills not moved by manual power.

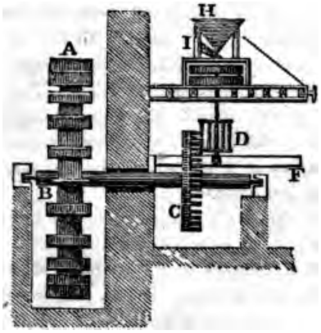
4. The modern corn and flour mill differs from the ancient hand-mill, in the size of the stones, in the addition of an apparatus for separating the hulls and bran from the farinaceous part of the grain, and in the power applied for putting it in motion.

5. The grinding surfaces of the stones have channels, or furrows, cut in them, which proceed obliquely from the centre to the circumference. The furrows are cut slantwise on one side, and perpendicu-

larly on the other; so that each of the ridges which they form, has a sharp edge: and when the upper stone is in motion, these edges pass one another, like the blades of a pair of scissors, and cut the grain more easily, as it falls upon the furrows.

6. The upper stone is a little convex, and the other a little concave. There is a trifling difference, however, between the convexity and concavity of the two stones: this difference causes the space between them to become less and less towards their edges; and the grain, being admitted between them, is, consequently, ground finer and finer, as it passes out in that direction; in which it is impelled, by the centrifugal power of the moving stone.

7. By a careful inspection of the following picture, the whole machinery of a common mill may be understood:



A, represents the water-wheel; B, the shaft to which is attached the cog-wheel C, which acts on the trundle-head, D; and this, in turn, acts on the moveable stone. The spindle, trundle-head, and upper stone, all rest entirely on the beam, F, which can be elevated or depressed, at pleasure, by a simple apparatus; so that the distance between the stones can be easily regulated, to grind either fine or coarse. The grain about to be submitted to the action of the mill, is thrown into the hopper, H, whence it passes by the shoe, or spout, I, through a hole in the upper stone, and then between them both.

8. If the flour, or meal, is not to be separated from the bran, the simple grinding completes the operation; but when this separation is to be made, the comminuted grain, as it is thrown out from between the stones, is carried, by little leathern buckets fastened to a strap, to the upper end of an octagonal sieve, placed in an inclined position in a large box. The coarse bran passes out at the lower end of the sieve, or bolt, and the flour, or fine particles of bran, through the bolting-cloth, at different places, according to their fineness. At the head of the bolt, the superfine flour passes; in the middle, the fine flour; and at the lower end, the coarse flour and fine bran; which, when mixed, is called *canel*, or *shorts*.

9. The best material of which millstones are made, is the burr-stone, which is brought from France in small pieces, weighing from ten to one hundred pounds. These are cemented together with plaster of Paris, and closely bound around the circumference, with hoops made of bar iron. For grinding corn or rye, those made of sienite, or granite rock, are frequently used.

10. A mill exclusively employed in grinding grain consumed by the inhabitants of the neighbourhood, is called a *grist* or *custom* mill; and a portion of the grist is allowed to the miller, in payment for his services. The proportion is regulated by law; and, in our own country, it varie according to the legislation of the differ States.

11. Mills in which flour is manufactured and packed in barrels for sale, are called merchant mills. Here, the wheat is purchased by the miller, or by the owner of the mill, who relies upon the difference between the original cost of the grain, and the probable amount of its several products when sold, to remunerate him for the manufacture, and his investments of capital. In Virginia, and, perhaps, in some of the other States, it is a common practice among the farmers to deliver to the millers their wheat, for which they receive a specified quantity of merchantable flour.

12. The power most commonly employed to put heavy machinery in operation, is that supplied by water. This is especially the case, with regard to mills for grinding grain; but when this cannot be had, a substitute is found in steam, and animal strength. The wind is also rendered subservient to this purpose. The wind-mill was invented in the time of Augustus Cæsar. During the reign of this emperor, and probably long before, mules and asses were employed both by the Greeks and Romans, in turning their mills. The period at which water-mills began to be used cannot be certainly determined. Some writers place it as far back as the Christian era.

13. Wheat flour is one of the staple commodities of the United States, and there are mills for its manufacture in almost every part of the country, where wheat is extensively cultivated; but our most celebrated flour-mills are on the Brandywine creek, in Delaware, and at Rochester, in New-York.

14. In our Southern States, hominy is a favourite article of food. It consists of the flinty portions of Indian corn, which have been separated from the hulls and eyes of the grain. To effect this separation, the corn is sometimes ground very coarsely in a mill; but the most usual method is that of pounding it in a mortar.

15. The mortar is excavated from a log of hard wood, between twelve and eighteen inches in diameter. The form of the excavation is similar to that of a common iron mortar, except that it is less flat at the bottom, to prevent the corn from being reduced to meal during the operation. The pestle is usually made by confining an iron wedge in the split end of a round stick, by means of an iron ring.

16. The white flint corn is the kind usually chosen for hominy; but any kind, with the requisite solidity, will answer the purpose. Having been poured into the mortar, it is moistened with hot water, and immediately beaten with the pestle, until the eyes and hulls are forced from the flinty portions of the grain. The part of the corn which has been reduced to meal, by the foregoing process, is removed by means of a sieve, and the hulls by the aid of the wind.

17. Hominy is prepared for the table by boiling it in water for twelve hours, with about one-fourth of its quantity of white beans, and some fat bacon. It is eaten while yet warm, with milk, or butter; or, if suffered to get cold, it is again warmed with lard, or some fat substance, before it is brought to the table.

THE BAKER.

1. The business of the Baker consists in making bread, rolls, biscuits, and crackers, and in baking various kinds of provisions.

2. Man appears to be designed by nature, to eat all substances capable of affording nourishment to his system; but, being more inclined to vegetable than to animal food, he has, from the earliest times, used farinaceous grains as his principal means of sustenance. As these, however, cannot be eaten in their native state, without difficulty, means have been contrived for extracting their farinaceous part, and for converting it into an agreeable and wholesome aliment.

3. Those who are accustomed to enjoy all the advantages of the most useful inventions, without reflecting on the labour expended in their completion, may fancy that there is nothing more easy than to grind g[illegible]in, to make it into paste, and to bake it in an oven: but it must have been a long time, before men came to prepare their grain in any other way than by roasting it in the fire, or boiling it in water, and forming it into viscous cakes. Accident, at length, probably furnished some observing person a hint, by which good and wholesome bread could be made by means of fermentation.

4. Before the invention of the oven, bread was exclusively baked in the embers, or ashes, or before the fire. These methods, with sometimes a little variation, are still practised, more or less, in all part of the world. In England, the poor of people place the loaf on the he

hearth, and invert over it an iron pot, or kettle, which they surround with embers or coals.

5. The invention of the oven must have added much to the conveniences and comforts of the ancients; but it cannot be determined, at what period, or by whom, it was contrived. During that period of remote antiquity, in which the people were generally erratic in their habits, the ovens were made of clay, and hardened by fire, like earthenware; and, being small, they could be easily transported from place to place, like our iron bake-ovens. Such ovens are still in use in some parts of Asia.

6. There are few nations that do not use bread, or a substitute for it. Its general use arises from a law of our economy, which requires a mixture of the animal fluids, in every stage of the process of digestion. The saliva is, therefore, essential; and the mastication of dry food is required, to bring it forth from the glands of the mouth.

7. The farinaceous grains most usually employed in making bread, are,—wheat, rye, barley, maize, and oats. The flour and meal of two of these are often mixed; and wheat flour is sometimes advantageously combined with rice, peas, beans, and potatoes.

8. The component parts of wheat, rye, and barley-flour, are,—fecula, or starch, gluten, and saccharine mucilage. Fecula is the most nutritive part of grain: it is found in all seeds, and is especially abundant in the potato. Gluten is necessary to the production of light bread; and wheat flour, containing it in the greatest proportion, answers the purpose better than any other. The saccharine mucilage is equally necessary, as this is the substance on which yeast and leaven act, in producing the internal commotion in the particles of dough during fermentation.

9. There are three general methods of making bread: 1st. by mixing meal, or flour, with water, or with water and milk; 2d. by adding to the foregoing materials a small quantity of sour dough, or leaven, to serve as a fermenting agent; and, 3d. by using yeast, to produce the same general effect.

10. The theory of making light bread, is not difficult to be understood. The leaven, or yeast, acts upon the saccharine mucilage of the dough, and, by the aid of heat and moisture, disengages carbonaceous matter, which, uniting with oxygen, forms carbonic acid gas. This, being prevented from escaping by the gluten of the dough, causes the mass to become light and spongy. During the process of baking, the increased heat disengages more of the fixed air, which is further prevented from escaping by the formation of the crust. The superfluous moisture having been expelled, the substance becomes firmer, and retains that spongy hollowness, which distinguishes good bread.

11. Many other substances contain fermenting qualities, and are, therefore, sometimes used as substitutes for yeast and leaven. The waters of several mineral springs, both in Europe and America, being impregnated with carbonic acid gas, are occasionally employed in making light bread.

12. The three general methods of making bread, and the great number of materials employed, admit of a great variety in this essential article of food; so much so, that we cannot enter into details, as regards the particular modes of manufacture adopted by different nations, or people. There are, comparatively, but few on the globe,

in which this art is not practised in some way or other.

13. It is impossible to ascertain at what period of time the process of baking bread became a particular profession. It is supposed, that the first bakers in Rome came from Greece, about two hundred years before the Christian era; and that these, together with some freemen of the city, were incorporated into a college, or company, from which neither they nor their children were permitted to withdraw. They held their effects in common, without possessing any individual power of parting with them.

14. Each bake-house had a patron, or superintendent; and one of the patrons had the management of the rest, and the care of the college. So respectable was this class of men in Rome, that one of the body was occasionally admitted as a member of the senate; and all, on account of their peculiar corporate association, and the public utility of their employment, were exempted from the performance of the civil duties to which other citizens were liable.

15. In many of the large cities of Europe, the price and weight of bread, sold by bakers, are regulated by law. The weight of the loaves of different sizes must be always the same; but the price may vary, according to the current cost of the chief materials. The law was such in the city of London, a few years ago, that if a loaf fell short in weight a single ounce, the baker was liable to be put in the pillory; but now, he is subject only to a fine, varying from one to five shillings, according to the will of the magistrate before whom he may be indicted.

16. In this country, laws of a character somewhat similar have been enacted by the legislatures of several States, and by city authorities, with a view to protect the community against impositions; but whether there be a law or not, the bakers regulate the weight, price, and quality, of their loaves, by the general principles of trade.

17. There is, perhaps, no business more laborious, than that of the baker of loaf bread, who has a regular set of customers to be supplied every morning. The twenty-four hours of the day are systematically appropriated to the performance of certain labours, and to rest.

18. After breakfast, the yeast is prepared, and the oven-wood provided: at two or three o'clock, the *sponge is set:* the hours from three to eight or nine o'clock, are appropriated to rest. The baking commences at nine or ten o'clock at night; and, in large bakeries, continues until five o'clock in the morning. From that time until the breakfast hour, the hands are engaged in distributing the bread to customers. For seven months in the year, and, in some cases, during the whole of it, part of the hands are employed, from eleven to one o'clock, in baking pies, puddings, and different kinds of meats, sent to them from neighbouring families.

19. In large cities, the bakers usually confine their attention to particular branches of the business. Some bake light loaf bread only; others bake unleavened bread, such as crackers, sea-biscuit, and cakes for people of the Jewish faith. Some, again, unite several branches together; and this is especially the case, in small cities and towns, where the demand for different kinds of bread is more limited.

THE CONFECTIONER.

1. The Confectioner makes liquid and [illegible] marmalades, pastes, [illegible] [illegible]

[illegible] accumulated.

2. [illegible] [illegible]; [illegible] skill and [illegible] with [illegible] better to pur- [illegible] the confectioner.

[illegible] preserves [illegible] fruits and ber- [illegible]—peaches, [illegible] plums, [illegible] gooseberries, [illegible] The fruit, of [illegible] confected by [illegible] candied syrup of [illegible] cooked. Dry confects are made by boiling the fruit a little in syrup, and then drying it with a moderate heat in an oven. The ancients confected with honey; but, at present, the more suitable article of sugar is almost exclusively employed for this purpose.

4. *Jellies* resemble a thin transparent glue, or size. They are made by mixing the juice of the fruits mentioned in the preceding paragraph, with a due proportion of sugar, and then boiling the composition down to a proper consistence. Jellies are also made of the flesh of animals; but such preparations cannot be long kept, as they soon become corrupt.

5. *Marmalades* are thin pastes, usually made of the pulp of fruits that have some consistence, and about an equal weight of sugar. *Pastes* are similar to marmalades,

in their materials, and mode of preparation. The difference consists, only, in their being reduced by evaporation to a consistence, which renders them capable of retaining a form, when put into moulds, and dried in an oven.

6. *Conserves* are a species of dry confects, compounded of sugar and flowers. The flowers usually employed, are,—roses, mallows, rosemary, orange, violets, jessamine, pistachoes, citrons, and sloes: orange-peel is also used for the same purpose.

7. *Candies* are made of clarified sugar, reduced by evaporation to a suitable degree of consistence. They receive their name from the essence, or substance, employed in giving them the required flavour.

8. *Sugar-plums* are small fruits, seeds, little pieces of bark, or odoriferous and aromatic roots, incrusted with hard sugar. These trifles are variously denominated; but, in most cases, according to the name of the substance inclosed by the incrustation.

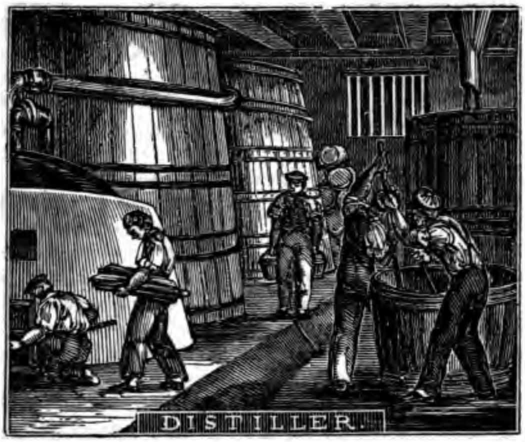
9. *Ice-cream* is an article of agreeable refreshment, in hot weather. It is sold in confectionary shops, as well as at the public gardens, and other places of temporary resort in cities. It is composed, chiefly, of milk or cream, fruit, and lemon-juice. It is prepared by beating the materials well together, and rubbing them through a fine hair sieve. The congelation is effected by placing the containing vessel in one which is somewhat larger, and filling the surrounding vacancy with a mixture of salt and fine ice.

10. *Cakes* are made of a great variety of ingredients; the principal of which are, flour, butter, eggs, sugar, water, milk, cream, yeast, wine, brandy, raisins, currants, caraway, lemon, orange, almonds, cinnamon, nutmeg, allspice, cloves, and ginger. The different combinations of these materials, produce so great a variety of cakes, that it would be tedious to detail even their names.

11. The confectioner, in addition to those articles which may be considered peculiar to his business, deals in various kinds of fruits and nuts, which grow in different climates. He also sells a variety of pickles, which he usually procures from those who make it a business to prepare them.

12. *Soda-water* is, likewise, often sold by the confectioner. This agreeable drink is merely water, impregnated with carbonic acid gas, by means of a forcing-pump. The confectioners, however, in large cities, seldom prepare it themselves, as they can procure it at less expense, and with less trouble, ready made.

13. Sometimes, the business of the pastry-cook is united with that of the confectioner, especially with that branch of it which relates to making cakes. Pies and tarts consist of paste, which, when baked, becomes a crust, and some kind of fruit or meat, or both, with suitable seasoning. The art of making pies and tarts is practised, more or less, in every family: it is not, therefore, essential to be particular in naming the materials employed, or the manner in which they are combined.



THE BREWER, AND THE DISTILLER.

THE BREWER.

1. **Brewing** is the art of preparing a liquor which has received the general denomination of beer. This beverage can be brewed from any kind of farinaceous grain; but, on various accounts, barley is usually preferred. It is prepared for the brewer's use, by converting it into malt; which is effected by the following process:

2. The grain is soaked in a cistern of water, about two days, or until it is completely saturated with that fluid. It is then taken out, and spread in a layer nearly two feet thick, upon a floor. When the inside of this heap begins to grow warm, and the kernels to germinate, the malster checks the rapid growth of the grain in that situation, by changing it to the outside. This operation is continued, until the saccharine matter in the barley has been sufficiently evolved, by the natural process of germination.

3. The grain is next transferred to the kiln, which is an iron or tile floor, perforated with small holes, and moderately heated beneath with a fire of coke, or stone coal. Here, the grain is thoroughly dried, and the principle of germination completely destroyed. The malt thus made is prepared for being brewed, by crushing it in a common mill, or between rollers. Malting, in Great Britain, and in some other parts of Europe, is a business distinct from brewing; but in the United States, the brewers generally make their own malt.

4. The first part of the process of brewing, is called *mashing*. This is performed in a large tub, or *tun*, having two bot-

toms. The upper one, consisting of several moveable pieces, is perforated with a great number of small holes; the other, though tight and immoveable at the edges, has several large holes, furnished with ducts, which lead to a cistern beneath.

5. The malt, designed for one mashing, is spread in an even layer on the upper bottom, and thoroughly saturated and incorporated with water nearly boiling, by means of iron rakes, which are made to revolve and move round in the tub, by the aid of machinery. The water, together with the soluble parts of the malt, at length pass off, through the holes before mentioned, into the reservoir beneath.

6. The malt requires to be mashed two or three times in succession, with fresh quantities of water; and the product of each mashing is appropriated to making liquors, of different degrees of strength.

7. The product of the mashing-tun is called wort, which, being transferred to a large copper kettle, is boiled for a considerable time with a quantity of hops, and then drawn off into large shallow cisterns, called coolers. When the mixture has become cool enough to be submitted to fermentation, it is drawn off into the working tun.

8. The fermentation is effected with yeast, which, acting on the saccharine matter, disengages carbonic acid gas. This part of the process requires from eighteen to forty-eight hours, according to the degree of heat which may be in the atmosphere.

9. The beer is then drawn off into casks of different dimensions, in which it undergoes a still further fermentation, sometimes called, the *brewer's cleansing*. During this fermentation, the froth, or yeast, works out at the bung-hole, and is received in a trough, on the edges of which the casks have been placed. The froth, thus discharged from the beer, is the yeast used by the brewers.

10. The products of the brewery are denominated, *beer*, *ale*, and *porter*. The difference between these liquors arises, chiefly, from the manner in which the malt has been prepared, the relative strength imparted to each, and the extent to which the fermentation has been carried.

11. There are several kinds of beer; such as table beer, half and half, and strong beer. They are adapted to use, soon after being brewed, and differ from each other but little, except in the degree of their strength.

12. Ale and porter are called stock liquors, because, not being designed for immediate consumption, they are kept for a considerable time, that they may improve in quality. Porter is usually prepared for consumption, by putting it into bottles. This is done, either at the brewery, or in bottling establishments. In the latter case, the liquor is purchased in large quantities from the brewer, by persons who make it their business to supply retailers, and private families.

13. We have evidence that fermented liquor was in use, three thousand years ago. It was first used in Egypt, whence it passed into adjacent countries, and afterward into Spain, France, and England. It was sometimes called the wine of barley; and one kind of it was denominated Pelusian drink, from the city Pelusium, where it was first made.

14. Among the nations of modern times, the English are the most celebrated for brewing good liquors. London porter is, especially, in great repute, not only in that city, but in distant countries. Much fermented liquor, of the different kinds, is consumed in the United States, wher
is also made in considerable perfectio

THE DISTILLER.

1. Ardent spirits may be extracted from any substance containing saccharine matter; but sugar-cane, grapes, apples, peaches, rye, corn, and rice, on account of their abundance, and superior adaptation to the purpose, are more commonly used than any other. As whiskey is the chief article of this kind, manufactured in the United States, it will be selected to illustrate the general principles of distillation.

2. Corn and rye are the materials from which this liquor is mostly extracted; and these are used, either together, or separately, at the option of the distiller. The meal is scalded, and mashed in a large tub: it is then permitted to stand until it has become a little sweet, when more water is poured upon it, and, at a certain temperature, regulated in part by the weather, a quantity of yeast is added. To aid in producing proper fermentation, a little malt is [illegible].

3. After a suitable fermentation has taken place, the mash, as it is called, is transferred to a large close tub, from the [illegible] a tube extending to the worm in another tub filled with cold water. The worm is a long spiral tube, [illegible] that it may occupy a small space.

4. The heat is applied to the close tub by means of steam, which is conveyed to it from a large copper or boiler, by a [illegible]. The heat causes the alcoholic [illegible] to rise like vapour, and [illegible] the worm, where they are condensed into a watery fluid which passes [illegible].

5. [illegible] the [illegible] becomes gradually [illegible] the spirit in the [illegible] consists only of [illegible]. The remains of the mash are given as feed to hogs and cattle.

6. Brandy is distilled from grapes, rum from molasses, arrack from rice, whiskey from various kinds of grain, peach-brandy from peaches, and cider-brandy from apples.

7. The great variety of articles employed in the production of different kinds of ardent spirits, must necessarily vary the process of distillation in some particulars; but, in all cases, fermentation and heat are necessary to disengage the alcoholic properties of the saccharine matter, and also an apparatus for condensing the same from a gaseous to a liquid form. In some countries, the *alembic* is used as a condenser, instead of a worm. The form of this instrument is much like that of the retort; and when applied, it is screwed upon the top of the boiler.

8. Spirits which come to market in a crude state are sometimes distilled, for the purpose of improving their quality, or for disguising them with drugs and colouring substances, that they may resemble superior liquors. The process by which they are thus changed, or improved, is called rectification. Many distilleries in large cities, are employed in this branch of business.

9. There is, perhaps, no kind of merchandise in which the public is more deceived, than in the quality of ardent spirits and wines. To illustrate this, it is only necessary to observe, that Holland gin is made by distilling French brandy with juniper-berries; but most of the spirits which are vended under that name, consist only of rum or whiskey, flavoured with the oil of turpentine. Genuine French brandy is distilled from grapes; but the article usually sold under that denomination, is whiskey or rum coloured with treacle or burned sugar, and flavoured with the oil of wine, or some kind of drug.

10. The ancient Greeks and Romans were acquainted with an instrument for distillation, which they denominated *ambix*. This was adopted, a long time afterward, by the Arabian alchymists, for making their chemical experiments; but they made some improvements in its construction, and changed its name to *alembic*.

11. The ancients, however, knew nothing of alcohol. The method of extracting this intoxicating substance, was probably discovered some time in the twelfth or thirteenth century; but, for many ages after the discovery, it was used only as a medicine, and was kept for sale exclusively in apothecary-shops. It is now used as a common article of stimulation, in almost every quarter of the globe.

12. But the opinion is becoming general, among all civilized people, that the use of alcohol, for this purpose, is destructive of health, and the primary cause of most of the crimes and pauperism, in all places where its consumption is common. The formation of Temperance Societies, and the publication of their reports, together with the extensive circulation of periodical papers, devoted to the cause of temperance, have already diminished, to a very great extent, the use of spirituous liquors.

13. Although the ancients knew nothing of distilling alcohol, yet they were well versed in the art of making wine. We read of the vineyard, as far back as the time of Noah, the second father of nations; and, from that period until the present, the grape has been the object of careful cultivation, in all civilized nations, where the climate and soil were adapted to the purpose.

14. The general process of making wine from grapes, is as follows: The grapes, when gathered, are crushed by treading them with the feet, and rubbing them in the hands, or by some other means, with the view to press out the juice. The whole is then suffered to stand in the vat, until it has passed through what is termed the *vinous* fermentation, when the juice, which, in this state, is termed *must*, is drawn off into open vessels, where it remains until the pressing of the husks is finished.

15. The husks are submitted, in hair bags, to the press; and the *must*, which is the result of this operation, is mixed with that drawn from the vat. The whole is then put into casks, where it undergoes another fermentation, called the *spirituous*: this occupies from six to twelve days. The casks are then bunged up, and suffered to stand a few weeks; when the wine is racked off from the lees, and again returned to the same casks, after they have been perfectly cleansed. Two such rackings generally render the wine clear and brilliant.

16. In many cases, sugar, brandy, and flavouring substances, are necessary, to render the wine palateable; but the best kinds of grapes seldom require any of these additions. Wine-merchants often adulterate their wines, in various ways, and afterwards sell them for those which are genuine. To correct acidity, and some other unpleasant qualities, lead, copper, antimony, and corrosive sublimate, are often used by the dealers in wine; though the practice is attended with deleterious effects to the health of the consumers.

17. The wines most usually met with in this country, are known by the following denominations, viz. *Madeira* and *Teneriffe*, from islands of the same names; *Port*, from Portugal; *Sherry* and *Malaga*, from Spain; *Champagne*, *Burgundy*, and *Claret*, from France; and *Hock*, from Germany.

THE BUTCHER.

1. MAN is designed by nature, to subsist on vegetable and animal food. This is obvious, from the structure of his organs of mastication and digestion. It does not follow, however, that animal food is, in all cases, positively required. In some countries, the mass of the people subsist chiefly, or entirely, on vegetables: this is especially the case in the East Indies, where rice and fruits are the chief articles of food.

2. On the other hand, the people who live in the higher latitudes subsist principally on the flesh of animals. This is preferred, not only because it is better suited to brace the system against the rigours of the climate, but because it is most easily provided. In temperate climates a due proportion both of animal and vegetable substances is consumed.

3. Although the skins of beasts were used for the purpose of clothing, soon after the fall of man, we have no intimation from the scriptures, that their flesh, or that of any other animal, was used until after the flood. The Divine permission was then given to Noah and his posterity, to use, for this purpose, "every moving thing that liveth:" but in the law of Moses, delivered several centuries after this period, many exceptions are to be found, which were intended to apply only to the Jewish people. These restrictions were removed, on the introduction of Christianity: the unbelieving Jews, however, still adhere to their ancient law.

4. The doctrine of transmigration has had a great influence in diminishing the consumption of animal food. This absurd notion arose somewhere in central Asia, and, at a very early period, it spread into Egypt, Greece, Italy, and finally among the remote countries of the ancient world. It is still entertained by the heathen nations of Eastern Asia, by the tribes in the vicinity of Mount Caucasus, and by some of the American savages, and African negroes.

5. The leading feature of this doctrine is, that the souls of departed men reappear on earth in the bodies of animals, both as a punishment for crimes committed during life, and as a means of purification from sin. This dogma was adopted by the Pythagoreans, a sect of Grecian philosophers; and, as a natural consequence, it led them, as it has ever done the votaries of this opinion, to the veneration of animals, and to abstinence from their flesh, lest they might devour that of some of their deceased friends or relatives.

6. People who dwell thinly scattered in the country, rear and slaughter the animals for the supply of their own tables; but in villages, large towns, and cities, the inhabitants depend chiefly on the butcher for their meat. The animals commonly slaughtered are, sheep, cattle, and hogs.

7. The butchers obtain their animals from the farmers, or from drovers, who make it a business to purchase them in the country, and drive them to market. The farmers near large cities, who have good grazing farms, are accustomed to buy lean cattle, brought from a distance, with a view to fatten them for sale. There are also persons in the cities, who might, with propriety, be called cattle brokers, since they supply the butchers of small capital with a single animal at a time, on a credit of a few days.

8. Every butcher who carries on the business, has a house in which he kills his animals, and prepares them for sale. When it is intended to slaughter an ox, a rope is thrown about his horns, or neck, with which he is forced into the slaughter-house, and brought to the floor by the aid of a ring. The butcher then knocks him on the head, cuts his throat, deprives him of his hide, takes out his entrails, washes the inside of his body with water, and cuts him up into quarters: the beef is now ready to be conveyed to the market-house. The process of dressing other quadrupeds varies but little from this, in its general details. The cellular substance of mutton, lamb, and veal, is often inflated with air, that the meat may look fat and plump.

9. In large cities and towns, the meat is chiefly sold in the market-house, where each butcher has a stall rented from the corporation. It is carried there in a cart, and cut into suitable pieces with a saw, knife, and a broad iron cleaver.

10. In some of the large cities, it is a practice among the butchers, to employ *runners* to carry the meat to the houses of those customers who may desire this accommodation. In villages, where there is no market-house, the butcher carries his meats from door to door, in some kind of vehicle.

11. Those who follow this occupation usually enjoy good health, and, as they advance in years, in most cases, become corpulent. Their good health arises from exercise in the open air; and their corpulency, from subsisting principally on fresh meats. It is thought, however, that their longevity is not so great as that of men in many other employments.

THE TOBACCO PLANTER AND THE TOBACCONIST.

[illegible]

1. [illegible] America, which was in common use among [illegible] when that continent was discovered by Europeans. [illegible] the natives of the [illegible] with those of [illegible] it was [illegible]. The [illegible] in the [illegible] languages which [illegible] the [illegible] in which the [illegible]

2. The plant was first introduced into Spain, then into Portugal and France, and, [illegible] into other countries of the Eastern continent. Sir Walter Raleigh carried it from Virginia to England, and taught [illegible] the various methods of [illegible] among the natives.

3. The introduction of this nauseous plant into Europe, was everywhere attended with ridicule and opposition. Hundreds of pamphlets were published, in various languages, dissuading from its use in the strongest terms. Even James the First, king of Great Britain, did not regard it as inconsistent with the royal dignity to take up his pen on the subject. In his "*Counter-blast to Tobacco*," published in 1603, occurs the following remarkable passage: "It is a custom loathsome to the eye, hateful to the nose, harmful to the brain; and, in the black fume thereof, nearest resembling the horrible Stygian smoke of the pit that is bottomless."

4. Pope Urban VIII. excommunicated those who took tobacco in churches; and Queen Elizabeth also prohibited its use in

houses of public worship. In 1689, an ordinance was published in Transylvania, threatening those who should plant tobacco with the confiscation of their estates. The grand-duke of Moscow, and the king of Persia, prohibited its use under the penalty of the loss of the nose, and even of life. At present, however, the consumption of tobacco is looked upon with so much greater indulgence, that all the sovereigns of Europe, and most of those of other nations, derive a considerable revenue from the trade in this article.

5. But it is truly astonishing, that the discovery of a nauseous weed, of an acrid taste, disagreeable odour, and deleterious qualities, should have had so great an influence on the social condition of nations; that its culture should have spread more rapidly than that of the most useful plants; and that it should, consequently, have become an article of extensive commerce.

6. Of this plant there are several species, which differ from each other, in size, strength, and flavour. Some one or more of these varieties, are cultivated in various parts of the world; but especially in North and South America, and in the West Indies. It is one of the staple productions of Maryland, Virginia, Kentucky, and Ohio. The whole value of the tobacco exported annually from the United States, amounts to about five millions of dollars.

7. The following description of the mode of cultivating this plant, and preparing it for the tobacconist, is applicable to the state of Maryland. A little variation in some of the details, would render it applicable to other parts of the world.

8. A small piece of ground, say one-sixteenth of an acre, is prepared by burning a large quantity of brush upon it. The surface is rendered light and even, by means of a hoe and rake; and the seeds, mixed with ashes, are sown as evenly as possible. After they have been covered with earth, the ground is trodden down with the bare feet. The tobacco beds are made in March, and the plants become fit for the field in eight or ten weeks.

9. The field, in which the cultivation of the crop is to be continued, is ploughed two or three times, and then cross-ploughed into equal checks, in each of which is made a hill. Immediately after a rain, the plants are transferred to these hills, in the same manner in which cabbages are transplanted. While the tobacco is growing, the ground is ploughed several times, in order to keep it light, and to aid in destroying the weeds. When the plants are nearly grown, the tops are lopped or cut off, to prevent them from running to seed, and to cause the leaves to grow larger and thicker.

10. In July or August, the tobacco-worms begin to make their appearance, and to threaten the whole crop with destruction. To arrest the ravages of these insidious enemies, all hands, both great and small, together with all the turkeys that can be mustered, are brought into the field. These worms are produced from the eggs of a large insect, called the horn-bug.

11. The tobacco, when ripe, is cut near the ground, and hung on small sticks about five feet in length, generally by pegs driven into the stalks. These sticks are then laid upon poles arranged at proper distances from each other, in the tobacco-house, shed, or hovel, as the case may be. It is then suffered to dry gradually in the atmosphere; or a large fire is made in the tobacco-house, to effect the drying more rapidly.

12. The leaves are next stripped the stalks, and tied in small bunches

cording to their quality. This can only be done when *in order*, or rather, when the leaves are rendered tough by the absorption of moisture from the atmosphere. These bunches, when the leaves are so damp that they will not break, and so dry that they will not heat, are packed in hogsheads by the aid of a large lever press. The tobacco is inspected in public warehouses, by men who have been appointed for the purpose by the public authorities.

THE TOBACCONIST.

1. It is the business of the tobacconist to convert the leaves of the tobacco plant into snuff, cigars, and smoking and chewing tobacco.

2. Although there may seem to be a great variety of snuffs, yet they may be all reduced to three kinds, viz. Scotch, rappee, and maccouba. These are variously modified by the quality of the tobacco, by some little variation in the manufacture, and by the articles employed in communicating the desired flavour.

3. In manufacturing snuff, the tobacco is ground in a mill of a peculiar construction. Before the weed is submitted to this operation, it is reduced to a certain degree of fineness, by means of a cutting machine; and then spread in a heap, one or two feet thick, and sprinkled with water, that it may *heat* and *sweat*. The time required in this preparation depends upon the state of the weather, and the kind of snuff for which the tobacco is designed.

4. Scotch snuff is made of the strongest sort of tobacco, and is put up in bladders and bottles, without being scented. Rappee and maccouba are put up in jars and bottles; and the former is generally scented with bergamot, and the latter with the ottar of roses. Sometimes, a mixture of several ingredients, agreeable to the olfactory nerves, are employed.

5. Cigars are composed of two parts, called the *wrapper* and the *filling*. The former is made of pieces of thin leaves, cut to a proper shape, and the latter of those which are more broken. In all cases, the leaves used in the manufacture of cigars are deprived of the stems, which are reserved, either to be converted into inferior kinds of snuff, or for exportation to Holland, where they are usually flattened between rollers, and afterwards cut fine for smoking tobacco, to be sold to the poorer class of people.

6. The value of cigars depends chiefly on the quality of the tobacco. The best kind for this purpose, grows on the island of Cuba, near Havana. Tobacco from this seed is raised in many other places; and such, among tobacconists, is called *seed:* but it passes, among smokers of limited experience, for the real Havana. A very fine silky tobacco of this sort, grows in Connecticut, which is much esteemed.

7. An expert hand will make five or six hundred Spanish cigars in a day, or from one thousand to fifteen hundred of those composed of Maryland or Kentucky tobacco. Making cigars, being light work, is well adapted to females, of whom great numbers are regularly employed in this branch of the business. Tobacco intended for the pipe, is cut in a machine; and, after having been properly dried, it is put up in papers of different sizes.

8. Chewing tobacco is almost exclusively prepared from the species of this plant which is cultivated in Virginia, chiefly in the vicinity of James river. It is better adapted than any other, to this purpose, on account of its superior strength, and the great amount of resinous matter which it contains.

9. The first operation in preparing chewing tobacco, is to deprive the leaves of the stems. The former are then twisted, by hand, into plugs of different sizes, or spun into a continued thread by the aid of the *tobacco-wheel*, which is a simple machine moved by a crank. The thread thus produced is formed into bunches or twists, containing a definite amount of tobacco.

10. The tobacco having been put into the form desired, is moistened with water, packed in strong kegs, and then pressed with powerful screw-presses. The whole process is completed by heating the kegs, with their contents, for several days, in an oven or a tight room made for the purpose. The same change in the quality of tobacco is also produced by suffering it to stand nine or twelve months, before it is disposed of to the consumers.

11. Snuff is very commonly used in the southern states, as a dentifrice, or, at least, it is applied to the teeth with this ostensible object. The application is made by means of a small stick, with the fibres minutely divided at one end. Although the tobacco seems to have the desired effect upon the teeth, so far as respects their appearance, yet its stimulating and narcotic powers are more to be dreaded in this mode of using it than in any other. Many females ruin their complexion and constitution, by *rubbing snuff;* and the deleterious effects of the practice are so well known, that few are willing to avow it, in their own case.

12. Tobacco is used, in some one of its various forms, by a great majority of mankind; and, although it is generally acknowledged to be, in most cases, injurious to the constitution, and often destructive of health, yet its consumption seems to be on the increase. It is one of the objects of trade, even in the most obscure parts of the world; and its devotees must and will have a supply, even though they stint themselves in food and clothing.

13. As regards the irresistible influence which this plant assumes over its votaries, it may be classed with alcohol and opium; although its effects are not so destructive, nor is the expense so considerable: yet this is an item by no means unworthy of attention, as the aggregate sum annually expended for this useless narcotic, in the United States, would be sufficient for the support of common schools in every part of the country.

14. The general use of tobacco is perpetuated from generation to generation, by the desire, common to children and young people, to act and appear like older persons. Few ever begin the use of this nauseous weed, because it is agreeable to the senses to which it is applied; but because they fancy, in their childish simplicity, that it confers upon them some additional importance

THE MANUFACTURER OF CLOTH.

1. Man, in the primitive ages, were clad with the skins of animals, until they had acquired sufficient skill to supply themselves with a better material. It cannot be determined, from history, at what time cloth began to be manufactured from animal or vegetable fibre; but it is evident, that it was done at a very early period; probably, long before the flood.

2. The fibres of the vegetable kind, most commonly applied to this purpose, are the bark of several kinds of trees, together with hemp, flax, and cotton; and those of the animal kingdom are, silk, the wool of the sheep and lama, and the hair or wool of the goat and camel.

3. That the general process of manu- ing cloth may be perfectly under- the manner of performing several operations must be separately described. For the purpose of illustration, cotton, wool, and flax, will be selected; because these are the materials of which our clothing is principally fabricated. The operations of making cloth, may be comprised under *carding* and *combing*, *spinning*, *weaving*, and *dressing*.

4. *Carding and Combing.*—Wool and cotton are carded, with the view of disentangling the fibres, and arranging them longitudinally, in small rolls. This is done by means of the teeth of two instruments called cards, used by hand on the knee, or in the carding machine, which acts on the same principle, although far more expeditiously.

5. Machines for carding wool are to be found in every district of country in the

United States, in which the people manufacture much of their woollen cloths in their own families. On account of the roughness of the fibres of wool, it is necessary to cover them well with grease, or oil, that they may move freely on each other, during the carding and spinning.

6. Long, coarse, or hard wools, used in the manufacture of camlets, bombazines, circassians, and other worsted fabrics, are not carded, but combed. In England, and in other countries where much of this kind of wool is used, wool-combing forms a distinct trade. The operation consists, chiefly, in drawing the locks through steel combs, the teeth of which are similar to our common flax-hatchel. The comb is heated to a certain temperature, to cause the fibres to straighten, and to remove from them the roughness which might otherwise cause the cloth made of them to thicken in washing, like flannel.

7. The old method of combing wool, however, has been in part superseded by the application of machines, the first of which was invented by Edmund Cartwright, of England, about the year 1790. The fibres of flax are arranged, and freed from tow, by drawing them through a hatchel.

8. *Spinning.*—The process of spinning consists in twisting the fibres into threads. The most simple method by which this is effected, is by means of the common spinning wheel. Of this well-known machine, there are two kinds; one of which is applied to spinning wool, cotton, and tow, and the other to spinning flax.

9. This operation is, in most cases, performed by females, in the following manner. The roll of cotton, or wool, is attached to the spindle, which is put in rapid motion by a band passing over it from the rim, or periphery, of the wheel. While the spinster is turning the wheel with the right hand, she brings back from the spindle her left, with which she has laid hold of the roll a few inches from the upper end. When the yarn thus produced has been sufficiently twisted, she turns it upon the spindle, and repeats the same operation until it is full. This yarn is formed into skeins, by winding it upon a reel.

10. The mode of spinning tow is a little different. The material having been formed into *bats* by hand-cards, the fibres are drawn out from between the fingers and thumb by the twisted thread, while the spinner gradually moves backward. Worsted is spun from combed wool nearly in the same manner.

11. The *flax* or *little wheel*, is moved by the foot, so that both hands of the spinner are used in supplying, disposing, and occasionally wetting the fibres, as they are drawn from the distaff. Two bands pass from the periphery of the wheel, each of which performs a distinct office: the one keeps in motion the spindle, which twists the thread; the other moves the fliers, which wind the thread upon a spool, as fast as it is produced.

12. Spinning was almost exclusively performed in the modes just described, until the year 1767, when Richard Heargreaves, of England, invented a machine for spinning cotton, which he called a *jenny*. This consisted, at first, of eight spindles, moved by a common wheel, or cylinder, which was worked by hand. The number of spindles was afterwards increased to eighty-four.

13. In 1769, Richard Arkwright, also an Englishman, invented the *water spinning frame*. The essential and most important feature of this invention, consists in drawing out the cotton, by causing it to pass between successive pairs of rollers,

which revolve with different velocities, and which act as substitutes for the thumb and fingers, as applied in common spinning. These rollers are combined with the spindle and fliers of the common flax wheel.

14. Another machine was invented by Samuel Crompton, in 1779. It is called a *mule*, because it combines the principles of the two preceding machines. It produces finer yarn than either of them, and has nearly superseded the jenny. Before the cotton is submitted to the spinning machine, it is prepared by several others, by which it is carded, extended, and partially twisted.

15. In the manufactories, the fine short wools, used in the fabrication of broadcloths, flannels, and a variety of other cloths, are carded by machinery, and spun on a *slubbing* or *roving machine*, and a jenny, or mule, in both of which the spindles are mounted on a carriage, which is moved backwards in stretching and twisting the material, and forwards in winding the thread upon the spindle.

16. Worsted still continues to be spun, in most cases, on the common spinning wheel, as it can be done more perfectly in this way, than by any other machine which has hitherto been invented. Several machines have been constructed, which spin coarse threads of flax very well, and with great rapidity; but the materials for fine linen fabrics are still spun on the ancient flax wheel.

17. *Weaving.*—The first step preparatory to weaving, is to form a warp, consisting of a number of threads, which extend through the whole piece. To produce this parallel arrangement, the yarn is wound upon spools, which are afterwards placed in a frame perpendicularly, by means of rods, on which they move as upon an axle. From these spools, the yarns are stretched, upon pegs, to the length of the proposed web, and are carried round or doubled a sufficient number of times to make it to the proper width. The same object is more expeditiously effected, by winding the yarn spirally on a revolving frame.

18. The next step consists in winding the warp on a cylindrical beam, which is usually about ten inches in diameter. The threads, being put through a harness, composed of moveable parts, called *heddles*, and also through a sley or reed, are fastened on the other side to a round stick, from which three ropes extend to another cylinder, on which the cloth is wound as fast as it is woven.

19. The heddles are suspended from cross-pieces, on the top of the loom, by means of cords and pulleys; and, during the operation of weaving, are moved up and down, alternately, by the aid of *treadles*. This reciprocal motion up and down causes the web to open; and, while in this position, a shuttle, containing the *woof*, *weft*, or *filling*, on a quill or bobbin, is passed through from right to left, or from left to right; this being done as often as the position of the warp is changed. The threads of the filling are beaten up by the reed, or sley, which is placed in the *lay*.

20. Weaving is a business extensive in its application, being divided into almost as many branches as there are woven fabrics. Plain cotton, linen, woollen, and twilled cloths, silks, satins, carpets, &c., are all woven in looms of some kind, constructed on the same general principles. Power-looms, driven by water or steam, are now generally introduced into the cotton and woollen manufactories, both in Europe and in this country. One person

can attend to two of these looms at the same time, and each one will weave between twenty and forty yards in a day.

21. *Dressing.*—Cotton fabrics, when the webs are taken from the loom, are covered with an irregular nap, or down, formed by the protruding ends of the fibres. From the finest cottons, this is removed, by drawing them rapidly over an iron cylinder, kept constantly red-hot by a fire within. The flame of coal-gas has recently been applied, to effect the same object.

22. Common domestic fabrics are taken from the loom, and, without further preparation, are folded up into pieces for sale. Finer articles are usually whitened and calendered, before they pass from the hand of the manufacturer. Stuffs of all kinds, made of vegetable fibres, are now whitened by immersing them in a solution of oxymuriate of lime. Cotton and linen goods, with a view of making them smooth and glossy, are calendered by causing them to pass between two steel rollers.

23. Many of the fine cottons are converted into calicoes, by transferring to them various colours. The process by which this is done, is called calico-printing, which will be described in a separate article.

24. The texture of the fabrics made of worsted, or long wool, is completed, when issued from the loom. The pieces are subsequently dyed, and then pressed between heated metallic surfaces, to communicate to them the required gloss. But weaving does not always complete the texture of the stuffs made of the short wools. When taken from the loom, the web is too loose and open, to answer the purposes to which such cloths are usually applied. It is, therefore, submitted to another process, called fulling.

25. *Fulling*, in common with almost every other operation pertaining to the manufacture of cloth, constitutes a separate trade. The art is only applied to stuffs composed of wool, or hair, as these only possess the properties which render it applicable. The practicability of fulling cloth, depends on a certain roughness of the fibres, which admits of motion in one way, and retards it in another. This may be more fully understood, by consulting the article on making hats.

26. The cloth, having been prepared by a proper cleansing, is deposited in a strong box, with a quantity of water and fuller's earth, or soap, and submitted to the action of the *pestles*, or *stampers*, which are moved in a horizontal direction, backwards and forwards, by means of appropriate machinery. This operation reduces the dimensions of the cloth, and greatly improves the beauty and stability of the texture. The cloth is afterwards dried in the open air, on frames prepared for the purpose.

27. After the cloth has been dyed, a nap is raised on one side of it, by means of the common teazle. The nap is next cut off to an even surface. This was formerly done with a huge pair of shears; but, within a few years, it has most commonly been effected by a machine, the essential part of which is a spiral blade, that revolves in contact with another blade, while the cloth is stretched over a bed, or support, just near enough for the projecting filaments to be cut off at a uniform length, without injuring the main texture. Pressing and folding the cloth complete the whole process.

28. A great proportion of the woollen fabrics worn in the United States, are manufactured in families, part of which is sent to the clothiers to be dressed. Much cotton yarn, spun at the manufactories, purchased for domestic use: formerly, th

raw material was procured, and spun into yarn on the big wheel. Coarse linens are also, extensively manufactured in families, especially among the German population.

29. The manufacture of cloth, from wool, was introduced into Britain by the Romans, some time in the Augustan age. At Winchester, they conducted the business on a scale sufficiently large to supply their army. After the Romans withdrew from the island in the fifth century, the art was comparatively neglected, and gradually declined until the reign of Edward III. This monarch invited into his dominions workmen from Flanders, in which country the manufacture had, for a long time, been in a flourishing condition.

30. Shortly after the first immigration of the Flemish manufacturers into England, an act was passed prohibiting the wearing of cloths made in any other country; and, in the time of Elizabeth, the manufacture had become so extensive, that the exportation of the raw material was forbidden by law.

31. It is supposed that there are now in Great Britain, thirty millions of sheep; whose annual produce of wool is worth, on an average, about seven millions of pounds sterling: to this may be added, five millions of pounds weight from foreign countries. This amount is increased in value, by manufacturing skill, to twenty or thirty millions of pounds. Not less than three millions of persons are supposed to be employed in this branch of British industry.

32. Both the woollen and cotton manufactures have arisen to great importance, of late years, in the United States; and, from the mechanical skill of our countrymen, the abundance of the raw material, ast amount of water-power, there on to anticipate a rapid and continual increase in these divisions of American enterprise.

THE SILK-WORM.

1. Silk is the production of a worm, of the caterpillar species, which, in due course, passes through several transformations, and, at length, becomes a butterfly, like others of the genus. It is produced from an egg, and when about to die, or rather again to change its form, spins for itself an envelope, called *a cocoon*. The worm then changes to a chrysalis, and, after remaining in this state twenty days, the butterfly, or moth, comes out, forcing its way through the cocoon. The moths, or butterflies, eat nothing; and die as soon as they have provided for the propagation of their species. Enough of these are suffered to come to maturity, to provide a sufficient stock of eggs. The rest are killed, in a few days after they have spun their task, either by heating them in an oven, or by exposing them to the rays of the sun.

2. The fibres are wound upon a reel. To render this practicable, the cocoons are put into water heated to a suitable temperature, which dissolves the gummy substance that holds the fibres together. A number of threads being detached, and passed through a hole in an iron bar, form, by the aid of the remaining glutinous matter, one thread, which is wound upon a reel into skeins.

3. The raw silk, thus produced and prepared, is sold to the manufacturers, who twist and double the fibres variously, and finally form them into threads, for sewing; or weave them into a great variety of fabrics, which are too well known to need particular description here.

4. According to the ancients, the silk

worm was originally a native of China, and the neighbouring parts of Asia, and had there been domesticated for a long time before it was known in Europe. For many years after silk was sold among the nations of the West, even the merchants were ignorant both of the manner and place of its production.

5. The Greeks became acquainted with silk, subsequently to the time of Alexander the Great; and the Romans knew little of the article, until the reign of Augustus. Dresses composed entirely of this material, were seldom worn; but the fabrics which had been closely woven in the East, were unravelled, and recomposed in a looser texture, intermixed with linen or woollen yarn.

6. The prodigal Heliogabalus is said to have been the first individual in the Roman empire, who wore a robe of pure silk. It is also stated, that the Emperor Aurelian refused his wife a garment of this description, on account of its exorbitant price. At that time, as well as at previous periods, it usually sold for its weight in gold.

7. A kind of gauze, originally made by the women on the island of Cos, was very celebrated. It was dyed purple, with the substance usually employed in communicating that colour in those days; but this was done before it was woven, as in that state it was too frail to admit of the process. Habits made of this kind of stuff, were denominated "dresses of glass," for the reason, that the body could be seen through them.

8. The Roman empire had been supplied with silk through the medium of the Persians, until the time of Justinian, in the year 555. This emperor, having become indignant at the rapacity of the silk-merchants, determined, if possible, to supply his people from the insect itself.

9. After many unsuccessful attempts, he, at length, obtained a small quantity of the eggs from India, by the assistance of two Persian monks, who had contrived to conceal them in the hollow of their canes. The seeds of the mulberry tree, on the leaves of which the worm feeds, were also procured at the same time, together with instructions necessary for the management of the worms.

10. For six hundred years after the period just mentioned, the rearing of these worms in Europe was confined to the Greek empire; but, in the twelfth century, Roger, king of Sicily, introduced it into that island, whence it gradually spread into Italy, Spain, France, and other European countries.

11. The silk-worm was introduced into England, by James the First; but it has never succeeded well in that country, on account of the dampness and coldness of the climate. The manufacture of fabrics from silk, however, is there very extensive; the raw material being obtained, chiefly, from Bengal, and Italy. In the latter of these countries, in France, and other parts of Europe, as well as in Asia, the manufacture is also extensive.

12. Some attention has been paid to the rearing of silk-worms in the United States, and attempts have been made to introduce the manufacture of silks. The mulberry has been planted, in various parts of the Union; and it is highly probable that, in a few years, we shall be able to obtain excellent silks, without sending for them to foreign countries.

THE DYER, AND THE CALICO-PRINTER.

THE DYER.

1. The art of dyeing consists in impregnating flexible fibres with any colour which may be desired, in such a manner that it will remain permanent, under the common exposures to which it may be liable.

2. The union of the colouring matter with the fibres receiving the dye, is purely chemical, and not mechanical, as in the case of the application of paints. Wool has the greatest attraction for colouring substances; silk comes next to it; then cotton; and, lastly, hemp and flax. These materials, also, absorb dye-stuffs, in different proportions.

3. Previously to the application of the dye, the greasy substance which covers res of wool, and the gluey matter on those of silk, are removed by some kind of alkali. Their natural colour is, also, discharged by the fumes of sulphur. The resinous matter, and natural colour of cotton and linen, are removed by bleaching.

4. The materials used in dyeing are divided into two classes—*substantive* and *adjective*. The former communicates durable tints, without the aid of any other substance previously applied; the latter requires the intervention of some agent which possesses an attraction, both for the colouring matter and the stuff to be dyed, in order [illegible] make the colour permanent. The substances used for this purpose, are usually termed *mordants*.

5. Agents capable of acting, in some way, as mordants, are very numerous; but *alumina*, *alum*, the *sulphate*, or *acetate of*

iron, the *muriate of tin*, and *nutgalls*, are principally employed. The mordant not only fixes the colour, but, in many cases, alters and improves the tints. It is always dissolved in water, in which the stuffs are immersed, previously to the application of the dye. Dyeing substances are also very numerous; but a few of the most important have, in practice, taken precedence of the others.

6. Blue, red, yellow, and black, are the chief colours, for which appropriate colouring substances are applied; but, by a judicious combination of these same materials, and by a proper application of mordants, intermediate hues of every shade are produced: thus, a green is communicated by forming a blue ground of indigo, and then adding a yellow, by means of quercitron bark.

7. The *blue dye* is made of indigo; the *red dye*, of madder, cochineal, archil, Brazil-wood, or safflowers; the *yellow dye*, of quercitron bark, turmeric, hickory, weld, fustic, or saffron; the *black dye*, of the oxide of iron, combined with logwood, or the bark of the common red, or soft maple, with the sulphate, or acetate of iron. The dyes made of some of these substances require the aid of mordants, and those from others do not.

8. In communicating the intermediate hues, the different dye-stuffs forming the leading colours are sometimes mixed; and, at other times, they are made into separate dyes, and applied in succession.

9. In this country, the business of the dyer is often united with that of the clothier; but where the amount of business will justify it, as in manufactories, and in cities or large towns, it is a separate business. The dyers sometimes confine their attention to particular branches: some dye wool only, or silk, while others confine themselves to certain colours, such as scarlet and blue. The principal profits of the dyer, when unconnected with manufacturing establishments, arise from dyeing garments, or stuffs, which have been partly worn.

10. The origin of the art of dyeing is involved in great obscurity, as the ancients have not furnished even a fable, which might guide us in our researches. It is evident, however, that the art must have made considerable progress, long before authentic history begins. Moses speaks of stuffs dyed blue, purple, and scarlet, and of sheep-skins dyed red. The knowledge of the preparation of these colours, implies an advanced state of the art at that early period.

11. Purple was the favourite colour of the ancients, and appears to have been the first which was brought to a state of tolerable perfection. The discovery of the mode of communicating it, is stated to have been accidental. A shepherd's dog, while on the sea-shore, incited by hunger, broke a shell, the contents of which stained his mouth with a beautiful purple; and the circumstance suggested the application of the shell-fish as a colouring substance. This discovery is thought to have been made about fifteen hundred years before the advent of Christ.

12. The Jews esteemed this colour so highly, that they consecrated it especially to the service of the Deity, using it in stuffs for decorating the tabernacle, and for the sacred vestments of the high-priests. The Babylonians, and other idolatrous nations, clothed their idols in habits of purple, and even supposed this colour capable of appeasing the wrath of the gods.

13. Among the heathen nations of antiquity, purple was appropriated to the use of kings and princes, w[illegible]ir subjects

were debarred the use of this favourite colour. In Rome, at a later period, purple habits were worn by the chief officers of the republic, and, at length, by the opulent, until the emperors reserved to themselves the exclusive privilege.

14. There were several kinds of shell-fish, from which this colouring substance was obtained, each of which communicated a shade somewhat different from the others. The kind collected near Tyre was the best; and hence the Tyrian purple acquired especial celebrity. So highly was it esteemed by the Romans, in the time of Augustus, that wool imbued with this colour was sold for one thousand denarii per pound, which, in our currency, amounts to one hundred and sixty-eight dollars.

15. After all, the boasted purple of antiquity is supposed to have been a very inferior dye, when compared with many which we now possess; and this is only one among many instances wherein modern science has given us a decided superiority over the ancients.

16. The colour second in repute with the people of antiquity, was scarlet. This colour was communicated by means of an insect called *coccus*, and which is now denominated *kermes*. Besides the various hues of purple and scarlet, several others were in some degree of favour; such as green, orange, and blue. The use of vegetable dyes appears to have been but little known to the Romans; but the Gauls had the knowledge of imparting various colours, even the purple and scarlet, with the juice of certain herbs.

17. The irruption of the northern barbarians into the Roman empire, destroyed them with the rest of the arts of civilization in the western parts of Europe; but, [illegible] red, more or less, in the [illegible] revived in the West, principally by means of the intercourse arising from the Crusades.

18. Although indigo seems to have been known to the ancient Greeks and Romans, yet it does not appear to have been used for dyeing. The first that was applied to this purpose in Europe, was brought from India by the Dutch; but its general use was not established, without much opposition from interested individuals. It was strictly prohibited in England, in the reign of Elizabeth; and, about the same time, in Saxony. Many valuable acquisitions were made to the materials employed in this art, on the discovery of America; among which may be enumerated, cochineal, logwood, Brazil-wood, and nicaragua, together with the soft maple and quercitron barks.

19. The first book on the art of dyeing was published in 1429. This, of course, remained in manuscript, as the art of printing had not then been discovered: an edition was printed in 1510. The authors to whom the world is most indebted for correct information on this subject, are Dufay, Hallet, Macquir, and Berthollet, of France; and Henry, and Bancroft, of England;—all of whom wrote in the eighteenth century.

THE CALICO-PRINTER.

1. Calico-printing is a combination of the arts of dyeing, engraving, and printing, wherewith is produced a great variety of figures, both in regard to form and colouring. This art is applicable to woven fabrics, and chiefly to those of which the material is cotton.

2. The first object, after preparing the stuffs, as in dyeing, is to apply a *mordant* to those parts of the piece which are to receive the colour. This is now usually done by means of a steel or copper cylinder, on which have been engraved the

proposed figures, as on plates for copper-plate-printing.

3. During the printing, the cylinder, in one part of its revolution, becomes charged with the mordant, the superfluous part of which is scraped off by a straight steel edge, leaving only the portion which fills the lines of the figures. As the cylinder revolves, the cloth comes into forcible contact with it, and receives the complete impression of the figures, in the pale colour of the mordant.

4. The cloth, after having been washed and dried, is passed through the *colouring bath*, in which the parts previously printed become permanently dyed with the intended colour. Although the whole piece receives the dye, yet, by washing the cloth, and bleaching it on the grass in the open air, the colour is discharged from those parts not impregnated with the mordant.

5. By the use of different mordants, successively applied, and a single dye, several colours are often communicated to the same piece of cloth: thus, if stripes are first made with the acetate of alumina, and then others with the acetate of iron, a colouring bath of madder will produce red and brown stripes. The same mordants, with a dye of quercitron bark, give yellow and olive, or drab.

6. Sometimes, the second mordant is applied by means of engravings, on wooden blocks. Cuts designed for this purpose, are engraved on the *side* of the grain, and not on the *end*, like those for printing books.

7. Calico-printing, so far as chemical affinities are concerned, is the same with dyeing. The difference consists, chiefly, in the mode of applying the materials, so as to communicate the desired tints and figures. The dye-stuffs most commonly employed by calico-printers, are indigo, madder, and quercitron bark: by a dexterous application of these, and the mordants, a great variety of colours can be produced. Indigo, being a substantive colour, does not require the aid of mordants, but, like them, when other dyes are used, is applied directly to the cloth, sometimes by the engraved cylinder or block, and at others with the pencil, by hand.

8. Calico-printing was practised in India, twenty-two centuries ago, when Alexander the Great visited that country with his victorious army. The operation was then performed with a pencil: this method is still used in the East, to the exclusion of every other. The art was also practised in Egypt, in Pliny's time.

9. Calicoes were first brought to England in the year 1631. They derive their name from the city of Calicut, whence they were first exported to Europe. This branch of business was introduced into London, in the year 1676. Since that time, it has been encouraged by several acts of parliament; but it never became extensive in England, until the introduction of the machinery for spinning cotton. It is supposed, that the amount of cottons annually printed in the United States, cannot be less than twenty millions of yards.

THE HATTER.

1. The business, peculiar to the hatter, consists in making hats from the fur or hair of animals, by the process called *felting*. The hair of animals is the only material, which can be firmly matted together in this way; yet, that of every animal is not suitable for this purpose. The fur of the beaver, the otter, the seal, the muskrat, the rabbit, the hare, the coney, and the nutria, together with the wool of the lama, sheep, and camel, are employed, to the exclusion of almost every other.

2. The skin of all animals having fur, is covered with two kinds of hair; the one, long and coarse; the other, short, fine, and thickly set. The coarse hair is pulled out from the skin, by the aid of a shoe-knife, and thrown away, while the fine, which is the fur, is cut from it with one of a circular form, such as the saddlers and harness-makers use in cutting leather.

3. In the application of the materials, the first object of the hatter is to make the *body*. In the common three, four, and five dollar hats, the body is composed of the wool of the sheep; but in those of greater value, it is usually made of the wool of the lama, and different kinds of cheap furs. In describing the process of making hats, one of the latter kind will be selected.

4. A sufficient quantity of the materials for the body, is weighed out, and divided into two equal parts. One of these is placed on a table, or, as the hatters call it, a *hurl*. The individual hairs composing this portion are separated, and lightly and

regularly spread out into a proper form, by the vibrations of a bow-string, which is plucked with a wooden pin.

5. The fur is then carefully compressed with a flat piece of wicker-work, denominated a hatter's basket, and covered with a damp piece of linen cloth, in which it is afterwards folded, pressed, and worked with the hands, until it becomes matted together into a *bat*. This bat is next folded over a triangular piece of paper, and formed into a conical cap.

6. When another bat has been made in the same way, from the other half of the materials, the two are put together to form one, which is then worked in the damp cloth as before, until it is much contracted and matted together. After this, having been conveyed to another room, it is rolled in a woollen cloth, pressed, rubbed, and worked with the hands and a rolling-pin, around a kettle of hot water, into which it is often plunged during the operation. This is called *planking*.

7. In this way, the materials are consolidated into *felt*, and the body contracted to the proper size. The reason why the process just described produces this effect, may be found in the nature of the fibres themselves. Upon a close examination, it will be observed that these are covered with little scales or beards, which admit of motion in one direction, but retard it in the other. This peculiar formation causes them to interlock in such a way, that they become closely matted together.

8. When the body has been dried, and shaved on the knee with a sharp knife, to free it from projecting filaments, it is stiffened with gum-shellac dissolved in alcohol, and then steamed in a box, to cause the stiffening to set. It is now prepared for being napped.

9. The fur for the nap is prepared on the hurl, like the conical cap first described. In applying the nap to the body, the latter is wet with hot water, and *flakes* of the former are matted down upon it, by working it, on the planks, around the kettle. After three layers have been put on in this way, the cap is beaten, while wet, with sticks, to raise the nap, and then drawn over a cylindrical block, which gives it the general form of a hat.

10. The nap having been raised with a card, it is prepared to be coloured. The dye is made, chiefly, of the extract of logwood, copperas, and verdigris. The hats, to the number of forty-eight, or more, are hung upon a wheel, by means of pegs, which pass through the centre of the blocks. This wheel can be turned, so as to keep one half of the hats alternately in the dye. After having been properly coloured, they are taken from the blocks, washed, and dried.

11. The hat is now prepared for the *finisher*, who first whips up the nap with a ratan, and, after having rendered it pliable with steam, draws it over the *finishing block*. The fibres composing the nap are properly disposed with a card and brush, and rendered smooth and glossy by means of a hot iron. The superfluous part of the rim is cut off with a blade, placed in a gauge. The hat is finished by adding suitable trimmings, the nature of which, and the mode of application, can be easily learned, by examining different kinds of hats.

12. Hats of various colours have been worn; but those most in use are black, white, and drab. The white hats, which are intended only for ladies and children, have a nap of rabbits' fur, selected from the white skins. Drab hats are also made of stuffs of the natural colour, assorted for that purpose.

13. The value of hats depends, of course, upon the workmanship, and the cost of the materials used in the manufacture. So great is the difference in these respects, that their price ranges between seventy-five cents and fifteen dollars. The woollen bodies, used by hatters, are now often procured from persons who devote their attention exclusively to that part of the business.

14. Woollen cloths have been made in England, by the process of felting, without spinning and weaving; but, on trial, they were found to be deficient in firmness and durability.

15. Some kind of covering for the head, either for defence or ornament, appears to have been usually worn, in all ages and countries, where the inhabitants have made the least progress in the arts of civilized life.

16. The form, substance, and colour of this article of dress, have been exceedingly various in different ages, according to the circumstances, or humour, of the wearer. The ancient Persians wore turbans, similar to those of the modern Turks; and the nations inhabiting the Indian Peninsula wore a kind of head-dress so large, that it divested the person of all proportion.

17. The imperial turban is said to have been composed of a great many yards of muslin, twisted and formed into a shape nearly oval, and surmounted with a woollen cap, encircled with a radiated crown. The turban of the prime minister was smaller in its dimensions, but of greater altitude. The chief magi, on account of his superior eminence, wore a higher turban than those of the monarch and minister united. Those worn by the inferior magi, were regulated by the dignity of the stations which they held.

18. The Jewish people, and the neighbouring nations, borrowed the turban from the Persians; but, at a later period, they very commonly adopted the cap which the Romans were accustomed to give to their slaves, on their manumission.

19. The ancient helmet, made of steel, brass, and sometimes of more costly materials, was worn as a piece of defensive armour in war, instead of the ordinary coverings, used while engaged in peaceful occupations.

20. Roman citizens went bare-headed, except upon occasions of sacred rites, games, and festivals; or, when engaged in travelling or war. They were accustomed, however, in the city, to throw over their head the lappet of their gown, as a screen from the wind or sun. The people of Scotland used to wear a kind of bonnet, as in some parts of that country they do at the present time; and the English, before the invention of felt hats, covered the head with knit caps and cloth hoods, and sometimes with hats made of thrummed silk.

21. The Chinese do not wear hats, but use a cap of a peculiar structure, which the laws of civility will not allow them to put off in public. The form and material of this is varied with the change of the season. That used in summer is shaped like a cone, is made of a beautiful kind of mat, and lined with satin; to this is added, at the top, a large tuft of red silk, which falls all round to the lower part of the cap, and which fluctuates gracefully on all sides, while the wearer is in motion. The kind worn in winter is made of shaggy cloth, bordered with some kind of fur, and ornamented in a similar manner.

22. Head-dresses, from their variety, simplicity, and mutability, were little regulated, in a commercial or manufacturing point of view, until the introduction of felt hats, which has occasioned a uniformity in

this article of dress, unknown in former ages.

23. Curiosity is naturally excited to become acquainted with the particulars of their invention, and the subsequent stages of improvement in the manufacture. But the operation of individual interest, so generally connected with the useful arts, seems to have concealed the whole in obscurity; and little information on the subject, can now be obtained.

24. The hatters have a tradition, that the art of felting originated with St. Clement, the fourth bishop of Rome. Under this impression, in Catholic countries, they adopt him as their patron saint, and hold an annual festival in his honour. The principle of felting is said to have been suggested to his mind, by the following circumstance: while fleeing from his persecutors, his feet became blistered, and, to obtain relief, he placed wool between them and his sandals. On continuing his journey, the wool, by the perspiration, motion, and pressure of the feet, assumed a compact form.

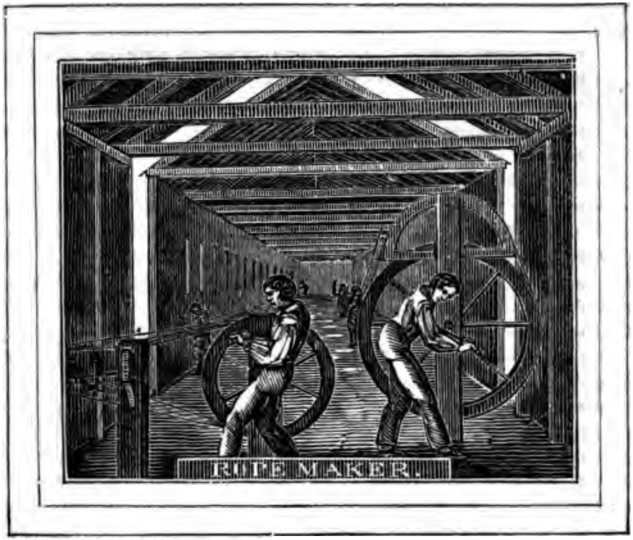
25. Notwithstanding this tradition, it appears that felt hats were invented at Paris, by a Swiss, about the commencement of the fifteenth century; but they were not generally known, until Charles the Seventh made his triumphal entry into Rouen, in the year 1492; when he astonished the people, by wearing a hat, lined with red silk, and surmounted with a plume of feathers.

26. When some of the clergy first adopted this article of dress, it was considered an unwarrantable indulgence: councils were held, and regulations published, forbidding any priest, or monk, to appear abroad, wearing a hat; and enjoining them to keep to the use of chaperons, or hoods, made of black cloth, with decent cornets; if they were poor, they were, at least to have cornets fastened to their hats, upon penalty of suspension and excommunication.

27. At length, however, the pope permitted even the cardinals to wear hats; but enjoined them to wear those of a red colour, at public ceremonials, in token that they were ready to spill their blood for their religion.

28. In England, considerable opposition was made to the use of the hat. By a statute, enacted in the thirteenth year of the reign of Elizabeth, every person between certain ages was obliged, on Sundays and holidays, to wear a woollen cap, made by some of the cappers of that kingdom, under the penalty of three shillings and four-pence for every day's neglect. This law continued in force, for about twenty-five years. The manufacture of hats was commenced, in England, in the time of Henry the Eighth, by Dutchmen and Spaniards.

29. Hats made of plaited straw, grass, or chip, are much used in the summer; and caps, of cloth or fur, are now frequently substituted for hats, in cold weather.



THE ROPE-MAKER.

1. Ropes may be made of any vegetable substance, which has a fibre sufficiently flexible and tenacious. The Chinese, and other orientals, in making ropes, use the ligneous parts of certain bamboos and reeds, the fibrous covering of the cocoa-nut, the filaments of the cotton pod, and the leaves of certain grasses; but the bark of plants and trees, is the most productive of fibrous matter suitable to this manufacture. That of the linden-tree, the willow, and the bramble, is frequently used. In Europe and America, however, the fibres of hemp and flax are more frequently employed, for this purpose, than any other material.

2. The operations of rope-making are commonly performed in *rope-walks*, which are sometimes more than a quarter of a mile in length. These are usually covered with a slight shed, the nature and appearance of which are well exhibited in the preceding picture.

3. The first part of the process consists in spinning the material into yarn. The principle on which this is effected, is the same as that by which cotton or wool is drawn out and twisted into threads, although the machinery, and the mode of operating, are different.

4. The kind of wheel employed in spinning rope-yarn, is also exhibited in the cut. A band passes around the periphery, and over the semicircle above it, in which is placed a number of wheels, the pivots of which terminate, on the other side, in small hooks.

5. The spinner, having a quantity of the

material properly disposed about the waist, attaches a number of fibres to one of the hooks, which, being put in motion by the band passing over the whirl, twists them rapidly into yarn: the part already twisted draws along with it more fibres from the bundle, and, as the spinner is regulating their uniform arrangement, he walks backward towards the other end of the walk.

6. When the thread has been spun to the proposed length, the spinner cries out to another, who immediately takes it off from the hook, gives it to a third person, and, in turn, attaches his own fibres to the same hook. In the meantime, the first spinner keeps fast hold of the end of his yarn, to prevent it from untwisting or doubling; and as it is wound on the reel, he proceeds up the walk, keeping the yarn of an equal tension throughout.

7. The second part of the process consists in forming the yarn into various kinds of ropes. The component parts of cordage, are called strands; and the operation of uniting them with a permanent twist, is called *laying*, when applied to small ropes, and *closing*, when applied to cables or other large ropes.

8. The simplest twist is formed of two strands. The thread used by sail-makers, and pack-thread, furnish examples of this kind: but cordage, with two strands, is not much used; that with three, is the most usual. Lines and cords less than one and a half inches in circumference, are laid by means of the spinning-wheel. Preparatory to this operation, the workman fastens the hither end of the yarns to separate whirl-hooks, and the remote ends to the hook of a swivel, called the *loper*.

9. The strands having been properly distended, the spinning-wheel is turned in the same direction as when twisting the yarns. A further twisting of the strands, during this part of the process, is prevented by the motion of the loper, which gives way to the strain, and, at the same time, causes the strands to entwine about each other, and form a cord. To prevent them from entwining too rapidly, an instrument is interposed, which, from its form, is called the *top:* it has two or more notches, which terminate at the apex, and a handle called a *staff.* As the top is moved from the loper to the wheel, it regulates the degree of twist which the cord or rope is to receive.

10. The principle on which large cordage is laid, or closed, is the same, although some part of the machinery is different. The strands for large ropes and cables are formed of many yarns, and require considerable *hardening.* This cannot be done with whirls driven by a wheel-band: it requires the power of a crank, turned by hand, or by some other considerable force. The strands, also, when properly hardened, become very stiff, and, when bent round the top, cannot transmit force enough to close the unpliant rope: it is, therefore, necessary that the loper, also, be moved by a crank.

11. Cordage, which is to be exposed to the alternate action of air and water, is usually tarred. The application of this substance is made, in most cases, while the material is in a state of yarn. In effecting this object, the threads are drawn through boiling tar, and then passed between rollers, or through holes surrounded with oakum, to remove the superfluous tar. In like manner, ropes and cables are superficially tarred.

12. Various improvements have been made, in the machinery for performing the different operations of rope-making; but, these not having been generally adopted,

it is unnecessary to notice them more particularly; especially, as they do not affect the general principles of the art.

13. Within a few years, cotton-yarn has been employed in the manufacture of ropes; but this material has not yet been sufficiently tested, to determine its fitness for the purpose. A kind of vegetable fibre brought from Manilla, and hence called Manilla hemp, is very extensively applied in making ropes, and, for some purposes, is preferred to other materials.

14. The intestines of animals are composed of very powerful fibres, and those of sheep and lambs are manufactured into what is called *cat-gut*, for the use of musical instrument-makers, hatters, watch-makers, and a variety of other artificers. Animal hair, as that from the tail and mane of horses, is frequently employed as the material for ropes; and such are durable, elastic, and impervious to moisture. They, however, are not applicable in cases where the rope is subject to considerable friction.

15. Hemp is cultivated in various parts of the world, and especially in Russia, whence it is exported to other countries in great quantities. It is also produced, to a considerable extent, in the state of Kentucky, and many other parts of the United States. Flax is still more generally cultivated, than hemp; but its chief application is to the manufacture of cloth, as it does not answer well for any cordage larger than a bed-cord. The formation of cloth from hemp, is also very common; and in this case, the yarn for the coarse cloths is spun on the rope-maker's wheel, in the manner already described. The cloth is generally used for making bags, sacking bottoms for beds, and sails for vessels.

16. Rope-making is a manufacture of general utility, as cordage of some kind is used more or less in every family in all civilized communities: nor are there many trades capable of being carried on, with convenience, without it. But the great utility of cordage, in all its varieties, is most conspicuous in the rigging and equipment of vessels; and the extensive demand for it, in this application, renders rope-making one of the most important and extensive of the primitive trades.

17. Nor does the utility of cordage end with its application to the purposes for which it was originally designed. Old ropes are converted into oakum, by untwisting and picking them to pieces. The oakum thus produced is driven into the seams of vessels, to render them water-tight.

18. As regards the invention of this art, nothing can be gathered from ancient records. We only know, in general, that cordage was in considerable use among the nations of antiquity, especially among the Greeks and Romans, who probably learned its application to rigging vessels from the Phœnicians.

THE TAILOR.

1. THE business of the tailor consists, principally, in cutting out, and making clothes for men and boys; together with habits and cloaks, for ladies. It is usual for persons who carry on this business, in cities and large towns, to keep a stock of cloths and other stuffs adapted to the season, which they make up into garments, to the order of customers. In such cases, they are termed *merchant tailors*.

2. The operation, preparatory to cutting out the cloth for a garment, is that of taking the measure of the person for whom it is designed. This is done with a narrow strip of paper, or parchment, and the dimensions are either marked on the measure with the scissors, or entered in a *pattern-book* kept for the purpose.

3. The cloth is cut to the proper shape, with a large pair of shears. This is performed, either by the individual who carries on the business, or by a foreman. The parts are sewed together, and the trimming applied, by means of thread and silk: this is commonly done by those who devote their attention to this branch of the trade. It sometimes happens, however, that the same person performs the whole of the work: this is particularly the case in country places, where the business is very limited in extent.

4. Females often serve an apprenticeship to this business. Many of them learn to cut out, and make with skill, certain kinds of garments; and are afterwards employed in families, or by the tailors. Most of the ready-made clothing, kept for sale in cities is made up by females.

5. The instruments employed in performing the operations of the tailor, are few and simple: the principal of these are the shears, the scissors, the needle, the thimble, the bodkin, the goose, and the press-board.

6. The great art of a master-tailor consists in fitting the dress to his customer, in such a manner as to conceal any defect of form, and display his person to the best advantage. He should, therefore, be a good judge of the human figure; as from this knowledge arises, chiefly, the superiority of one workman over another, in this branch of the business.

7. The first hint on the art of clothing the human body, was given to man by the Deity himself; for we read in the Scriptures, that "Unto Adam and to his wife the Lord God made coats of skins, and clothed them." From that time to the present, the art of cutting out garments, and of sewing their different parts together, has been practised, more or less, in every place, where there has been any degree of civilization.

8. For a long time, it is probable that thongs and the sinews of animals were used, for want of thread made of silk or vegetable fibre; and, doubtless, the same necessity caused the substitution of pointed bones and thorns, instead of needles. Such rude materials and instruments are still employed for similar purposes, by savage nations. The dresses of the people of Greenland are sewed together with thongs made of the intestines of the seal, or of some fish, which they have the address to cut fine, after having dried them in the air; and even the inhabitants of Peru, although considerably advanced in civilization, when that country was first visited by the Spaniards, made use of long thorns, in ng and fixing their clothes.

9. We have no means of determining at what period of the world this art was first practised, as a particular profession. We know, in general, that the dress of the ancients was usually more simple in its construction, than that of the people of modern times; and, consequently, it required less skill to put the materials in the required form. It may, therefore, be inferred, that either the females or the slaves of each family usually made up the clothing of all its members.

10. The distinguishing dress of the Romans was the *toga*, or gown; as that of the Greeks was the *pallium*, or cloak. The toga was a loose woollen robe, and covered nearly the whole person: it was round and close at the bottom, and open at the top, having no sleeves, but only a large flap, or lappet, which was either thrown over the left shoulder, or over the head, to protect it from the heat or cold.

11. The Romans, at an early period of their history, used no other dress, and it was also, at that time, worn by the women. Afterwards, they wore, under the toga, a white woollen vest called *tunica*, which extended a little below the knee: at first it was without sleeves. Tunics reaching to the ancles, or having sleeves, were reckoned effeminate; but under the emperors, they became fashionable.

12. The toga was usually assumed at the age of seventeen. Until then, the youth wore a kind of gown, bordered with purple, denominated *toga prætexta;* and such a garment was also worn by females, until they were married. The youthful dress was laid aside, and the *toga virilis*, or manly toga, assumed with great solemnity; as, by this act, the individual assumed the responsibility of a citizen. The toga was worn chiefly in the city, and only by Roman citizens.

MILLINER

THE MILLINER, AND THE LADY'S DRESS-MAKER.

THE MILLINER.

1. The milliner is one who manufactures and repairs bonnets and hats, for ladies and children. Her business requires the use of pasteboard, wire, millinette, silks, satins, muslins, ribands, artificial flowers, spangles, and other materials, too numerous to be mentioned.

2. The first part of the process of making a hat, or bonnet, consists in forming a crown of millinette; which operation is performed on a block, of a suitable size and shape: and to this is applied pasteboard, or millinette, edged with wire. The foundation having been thus laid, it is usually covered and lined with some of the materials just enumerated, and finished by applying to it the trimmings required by the fashion, or by the individual customer.

3. Ladies' hats are also made of rye straw, and a kind of grass, which grows in Italy: those made of the latter material are called *Leghorns*, from the name of the city, in or near which they are principally made. A few years since, these had almost superseded those made of straw; but the latter, of late, have nearly regained their former ascendency.

4. In the United States, and likewise in various parts of Europe, there are several establishments for making straw hats, in which the proprietors employ females to perform the whole labour. The straw is first cut into several pieces, so as to leave out the joints, and then whitened by smoking them with the fumes of brimstone. They are next split longitudinally into several pieces, by a simple machine

and afterwards plaited with the fingers and thumbs. The braid, or plait, thus produced, is formed into hats, according to the prevailing fashion.

5. Great quantities of straw are, also, plaited in families, especially in the New-England states, and sold to neighbouring merchants, who, in turn, dispose of it to those who form it into hats. The milliners usually keep a supply of Leghorn and straw hats, which they line and trim according to the fancy of their customers.

6. Head-dresses were probably used nearly as early as any other part of dress; and their form and material have likewise been equally variable. In the early days of Rome, the head-dress of the women of that city was very simple; and when they went abroad, which was seldom, they covered their faces with a veil; but when riches and luxury had increased, dress became, with many, the principal object of attention; hence, a woman's toilet and ornaments were called her *world*.

7. The head-dresses of the ladies, in various parts of Europe, especially in the eighteenth century, were particularly extravagant; being sometimes so high, that the face seemed to be nearly in the centre of the body. In 1714, this fashion was at its height, in France; but two English ladies, visiting the court of Versailles, introduced the low head-dresses of their own country.

8. The high head-dresses had no sooner fallen into disuse in France, than they were adopted in England, and even carried to a greater degree of extravagance. To build one of these elevated structures in the fashionable style, both the barber and milliner were necessary. The head-dresses of th[illegible] of the present age, are cha[illegible] great simplicity, when compared with those of several periods in preceding ages.

THE LADY'S DRESS-MAKER.

1. This business is nearly allied to the foregoing, and is, therefore, often carried on in conjunction with it. This is especially the case, in villages and small towns, where sufficient business cannot be obtained in the exclusive pursuit of one branch.

2. The customers of the lady's dress-maker, are not always easily pleased, as they frequently expect more from her skill than it is possible to accomplish. She, however, can do much towards concealing the defects of nature; and, by padding and other means, can sometimes render the person tolerably well proportioned, when, in its natural shape, it would be quite inelegant. It is to be regretted, however, that dress-makers are guided by fashion and whim, in moulding the external form of females, rather than by the best specimens of the human figure, as exhibited by eminent painters and sculptors.

3. The dress-maker should have some acquaintance with the anatomy and functions of those parts to which pressure is usually applied: for, who that knows the structure, size, and office of the liver, and other internal organs of digestion and vitality, would venture to apply to them a compressive force, calculated to interfere most seriously, if not dangerously, with their healthful action?

4. The fashions for ladies' dresses are chiefly procured from France, and the dress-makers from that country are, therefore, often preferred by fashionable ladies: sometimes, however, a dress-maker, having a name with a French termination, will answer the purpose.

THE BARBER.

1. It is the business of the barber to cut and dress the hair, to make wigs and false curls, and to shave the beards of other men. In ancient times, he used also to trim the nails; and even at the present day, in Turkey, this is a part of his employment.

2. The precise period when men began to shave their beards, is not certainly known. It appears that the practice was common among the Israelites, in the time of Moses; as that legislator has left on record a prohibitory law concerning it. They probably borrowed the custom from the Egyptians. It is stated by Plutarch, that Alexander the Great ordered his men to be shaved, that their enemies might not lay hold of their beards in time of battle. Before this time, however, many of the Greeks shaved their beards.

3. The practice does not appear to have been introduced amongst the ancient Romans, until about the year 296 before the Christian era, when Paulus Ticinius Mænas brought to Rome a number of barbers from Sicily. Scipio Africanus was the first man who shaved his beard every day.

4. At first, the barbers had no shops, but shaved their customers at the corners of the streets. After a while, they followed their vocation in shops, or shades; and, at this period, it was customary for females to officiate in the various branches of the art. These places, however, were frequen only by the poorer class of the people

opulent families generally kept slaves for the performance of these duties. The day on which a young Roman first cut off his beard, was celebrated by him and his friends as one of peculiar interest; and this much-desired indication of manhood was consecrated to some one of the gods, generally to Jupiter Capitolinus.

5. The return of barbarism, in the fifth and sixth centuries, banished this custom from the western empire of Rome; nor was it again revived until the seventeenth century. During the reigns of Louis XIII. and Louis XIV. of France, both of whom ascended the throne in boyhood, the courtiers and fashionable people began to use the razor, that they might appear with smooth chins, and thus resemble, in this particular, the youthful monarchs. From France, the fashion, at length, spread all over Europe. At one time, in the reign of the English queen Elizabeth, the fellows of Lincoln's Inn were compelled by statute to shave their beards at least once in two weeks: omission was punished with fine, loss of commons, and finally with expulsion.

6. The custom of shaving was introduced into Russia by Peter the Great, who compelled his subjects to pay a tax for the privilege of retaining their beards. This singular impost was exceedingly unpopular, and excited greater complaints amongst the people, than any other measure of that emperor. The decree was rigidly enforced, and every one who would not, or could not, pay the tax, was forcibly deprived of this favourite ornament, if he would not remove it voluntarily. Some of the people saved the sad trimmings of their chins; and, that they might never be entirely separated from these precious ordered that they should be depo- th their bodies in their coffins.

7. Among the European nations that have been curious in whiskers, the Spaniards have been particularly distinguished; and the loss of honour among them used to be punished by depriving the individual of his whiskers.

8. The Portuguese were but little, if at all, behind the Spaniards, in their estimate of these valuable ornaments. As an evidence of this, it is stated, that in the reign of Catharine, Queen of Portugal, the brave John de Castro, having taken the castle of Diu in India, and being afterwards in want of money, applied to the inhabitants of Goa to loan him one thousand piastres, and, as security for that sum, sent them one of his whiskers, telling them that "All the gold in the world cannot equal the value of this natural ornament of my valour." The people, in admiration of his magnanimity, sent him the money, and, at the same time, returned his incomparable whisker.

9. In the reign of Louis XIII. of France, whiskers attained the highest degree of favour. They also continued in fashion during the early part of the succeeding reign: Louis XIV. and the great men of France, took a pride in wearing them. It was no uncommon thing, at that time, for the ladies to comb and dress the whiskers of their beaux; and the men of fashion were particular in providing whisker-wax, and every article necessary to this agreeable pastime.

10. The whiskers of the Chinese philosopher Confucius, attached to his idol, which is preserved by his countrymen, are supposed to be capable of conferring upon those who might wear them, a portion of the wisdom and manly beauty of that illustrious sage. Great care, however, is taken that none shall enjoy these great personal qualifications, by such easy means; as

decapitation is the penalty for plucking the whiskers from the position which they occupy.

11. When the practice of shaving off the beard was again revived in Europe, instrumental music was employed in the barber's shop, to amuse customers waiting their turn; but at the present time, newspapers are furnished for this purpose. In taking off the beard, soft water, good soap, a brush, and a sharp razor, are the usual requisites. The razor should be placed nearly flat on the face, and be moved from point to heel. Barbers usually have many regular customers, each one of whom, in general, has a box of soap and a brush appropriated to his individual use.

12. In ancient times, great attention was paid to dressing the hair. The Hebrew women plaited, and afterwards confined it with gold and silver pins: they also adorned it with precious stones. The Greeks, both male and female, at nearly every period of their ancient history, wore long hair, which they usually permitted to hang gracefully upon the shoulders, back, and sometimes upon the breast.

13. Adult males, among the Romans, usually wore their hair short, and dressed with great care, especially in later ages, when attention to this part of the person was carried to such excess, that ointments and perfumes were used even in the army. The hair was cut for the first time, when the boy had attained his seventh year, and the second time when he was fourteen years old. His locks, at each cutting, were commonly dedicated to Apollo or Bacchus.

14. Both men and women, among the Greeks and Romans, sometimes permitted their hair to grow in honour of some divinity. The Jews, also, when under the vow of a Nazarite, were not permitted to trim their hair or beards. In grief and mourning, the Romans suffered their hair and beards to grow: the Greeks, on the contrary, when in grief, cut their hair and shaved their beards, as likewise did some of the barbarous nations of early time.

15. Artificial hair began to be fashionable, at an early period; and was used by the Greeks, Carthaginians, and Romans. In the time of Ovid, blond hair was in great favour at Rome; and those ladies who did not choose to wear wigs, powdered their hair with a kind of gold dust. They wore hanging curls all round the head, to which they were fastened with circular pins of silver. Every wealthy Roman lady of fashion kept at least one slave, to frizzle and curl the hair.

16. The time when wigs first came into use, cannot be now ascertained. It is certain, however, that they were worn by females a long time before they became fashionable among the men.

17. Wigs, perukes, or periwigs, were revived in the seventeenth century. In the reign of Louis XIII., or about the year 1629, they became fashionable at Paris; and, as that city was generally imitated by the rest of Europe, in things of this nature, they soon became common. The wigs were very large, as may be seen by examining ancient portraits, and were covered with a profusion of hair-powder. At first, it was disreputable for young people to wear them, as the loss of the hair, at an early age, was attributed to a disease, which was, of itself, discreditable.

18. When wigs were first introduced into England, some of the clergy opposed them violently, considering their use more culpable than wearing long hair, since, as they alleged, it was more unnatural. Many preachers inveighed against wigs in their sermons, and cut their own hair

shorter, to manifest their abhorrence of the reigning mode.

19. The worldly-wise, however, observed that a periwig procured for the wearer a degree of respect and deference which otherwise might not have been accorded; and hence there was a strong tendency to the use of this appendage. The judges and physicians, especially, understood well this influence of the wig, and gave to it all the advantages of length and breadth. The fashion, at length, was adopted by the ecclesiastics themselves, not only in England, but in most of the European kingdoms, as well as in the British colonies of America.

20. The fashion, however, except in cases of baldness, wherein alone it is excusable, is now nearly banished from Europe and America. This desirable change was effected, principally, by the example of republican America, and by the influence of the French Revolution. The law passed in England in 1795, imposing a tax of a guinea a head per annum on those who wore hair-powder, contributed to the same result, as well as to diminish the use of that article.

21. The manufacture of wigs and false curls, is an important branch of the business of the barber. The first process in forming a wig, is to produce in the hair about to be used for this purpose, a disposition to curl. This is done by winding it on a cylinder of wood or earth, and afterwards boiling it in water. It is then dried, and baked in an oven. Thus prepared, it is woven on a strong thread, and is subsequently sewn on a caul fitted to the head. False curls are made on the same principle.

22. Wigs and false curls were not made, in ancient times, precisely in the same manner; although their appearance, when finished, was probably similar. The hair was then applied directly to a piece of thin leather, by means of some adhesive substance, or composition.

23. Many barbers, especially those who have a reputation for making wigs and false curls in a fashionable style, keep for sale perfumery, as well as a variety of cosmetics.

24. From the eleventh to the eighteenth century, surgical operations were almost exclusively performed by the barbers and bath-keepers. As phlebotomy was one of the chief sources of profit to the barbers, they adopted a sign, emblematical of this operation. It consisted of a pole, representing the staff which the individual held in his hand, while the blood was flowing from the arm. The white band wound spirally about the pole, represented the fillet of linen, with which the arm was afterwards secured.

25. It is hardly necessary to remark, that the same sign is still employed by the barbers, although, with a few exceptions, they have ceased to perform the operation of which it was significant.

TANNER & CURRIER.

THE TANNER, AND THE CURRIER.

THE TANNER.

1. The art of tanning consists in converting hides and skins into leather, by impregnating them with astringent matter.

2. It is impossible to determine the period at which the art of tanning was discovered. It was doubtless known to the ancients, and probably to the antediluvians, in some degree of perfection; since skins were applied as means of clothing the human body, before the arts of spinning and weaving were practised. It is likely, however, that they were applied to this purpose, for a considerable time, in their natural state; and that accident, at length, suggested the means of rendering them more applicable, by saturating them with certain mineral or vegetable substances.

3. Although the art of converting skins into leather was practised in remote ages, yet it was not until near the end of the eighteenth century, that the true principle of the process was understood. Before this time, it was supposed that the astringent principle of the agents employed was a resinous substance, which adhered mechanically to the fibres, and thus rendered them firm and insoluble. The correct explanation was first given by Deyeux, and afterwards more fully developed by M. Seguin. These chemists clearly proved, that the formation of leather was the result of a chemical union between a substance called tannin, and the gelatinous part of the skin.

4. The subject, however, was not thoroughly understood, and reduced to scientific principles, until the year 1803, whe

Sir Humphry Davy gave it a careful investigation, in a series of chemical experiments. These inquiries resulted in the conviction, that the method of tanning which had been in general use, may, with a few alterations, be considered preferable to that by which the process is carried on with more rapidity.

5. The skin which envelopes the bodies of animals, consists of three layers: that on the outside is a thin, white, elastic membrane, called the *cuticle*, or *scarf skin;* that on the inside is a strong membrane, denominated the *cutis*, or *true skin;* between these two is a very thin membrane, to which anatomists have given the name *rete mucosum*, and in which is situated the substance which gives colour to the animal. The cutis is composed of fibres, which run in every direction, and, being by far the thickest layer, is the one that is converted into leather.

6. The skins of large animals, such as those of the ox and horse, are denominated hides; and those of smaller animals, as of the calf, goat, and sheep, are called skins. Of the former description, is made thick, of the latter, thin leather. The process of tanning different skins, varies in many particulars, according to the nature of the leather, and the uses to which it is to be applied.

7. The general process of changing thick hides into sole-leather, is as follows: They are first soaked in water, to free them from dirt and blood; and then, if rigid, they are beaten and rubbed, or rolled under a large stone, to render them pliable. They are next soaked in lime-water, or hung up in a warm room, and smoked until a slight putrescency takes place. The hair, cuticle, rete mucosum, on one and the fleshy parts on the other, are then scraped off, on a *beam*, with a circular knife.

8. Nothing now remains but the cutis, or true skin. Several hides, in this state of preparation, are put together into a vat, for the purpose of impregnating them with tannin. This substance is found in astringent vegetables, and is obtained in a proper state for application, by infusion in water. In that condition, it is called *ooze*, which is first applied in a weak state.

9. After the ooze of different degrees of strength has been renewed several times, they are put between layers of bark, and suffered to remain several months; fresh bark, from time to time, being supplied. The whole process generally occupies from twelve to sixteen months. When strong solutions of tannin are used, the leather is formed in a much shorter time; but, in that case, it is much more rigid, and liable to crack. It is rendered smooth and compact, by beating it with a wooden beetle, or by passing it between rollers.

10. Oak bark, on account of its cheapness, and the quantity of tannin which it contains, is more extensively employed by tanners, than any other vegetable substance. In sections of country where this kind cannot be conveniently obtained, the bark of the hemlock, spruce, and chestnut, the leaves of the sumach, and various other astringents, are substituted.

11. The process of tanning calf-skins is somewhat different in many of its details. They are first put into a solution of lime, where they remain during ten or fifteen days, and are then scraped on both sides, on the beam, with a circular knife, as in the former case, and for the same purpose. They are then washed in water, and afterwards immersed in an infusion of hen or pigeon's dung: here they are left for a

week or ten days, according to the state of the weather and other circumstances; during which time, they are frequently *handled*, and scraped on both sides. By these means, the lime, oil, and saponaceous matter, are discharged, and the skin is rendered pliable.

12. They are next put into a vat containing weak ooze, and afterwards removed to several others of regularly increasing strength. In the mean time, they are taken up and handled every day, that they may be equally acted upon by the tanning principle. The time occupied in the whole process, is from two to six months. The light and thin sorts of hides, designed for upper leather, harnesses, &c. are treated in a similar manner.

13. The tanner procures his hides and skins from various sources, but chiefly from the butcher, and from individuals who kill the animals for their own consumption. Great quantities of dry hides are also obtained from South America, where cattle are killed in great numbers, principally for the sake of this valuable envelope of their bodies

THE CURRIER.

1. It is the business of the currier to dress the thinner kinds of leather, which he procures from the tanner in an unfinished state. In most cases, in the United States, except in and near large cities, the business of tanning and currying are usually united in the same individual; or, at least, the two branches of business are carried on together, by the aid of workmen skilled in their respective trades.

2. The mode of dressing the different kinds of skins, varies in some respects; but, as the general method of operating is the same in every sort, a description applicable in one case will convey a sufficiently accurate idea of the whole. We shall, therefore, select the calf-skin, since it is more frequently the subject of the currier's skill, than any other.

3. The skin is first soaked in water, until it has become sufficiently soft, and then shaved with the *currier's knife*, on the inner side, over the *currier's beam:* it is then placed on a table, somewhat inclined from the workman, and scoured on both sides with the edge of a narrow, smooth stone, set in a handle; and again, with an iron *sleeker*, of a similar shape. The skin is next *stuffed* with a composition of tallow and tanner's oil on the flesh side, and then hung up to dry. Afterwards it is rubbed on the hair side with a board, and again scraped on the flesh side with the knife. Having been thus prepared, the skin is blacked on the flesh side with lampblack and tanner's oil, and subsequently rubbed with paste, applied with a brush. When it has been dried, the whole process is finished by rubbing both sides with a glass sleeker.

4. Horse hides are blacked on the hair side, or, as the curriers term it, on the *grain*, with a solution of copperas water. Leather designed for harnesses, for covering carriages, and for other similar purposes, is also blacked on that side in the same manner.

5. The trade of the currier is divided into two or three branches. Some dress only calf-skins, and other thick leather designed for shoes, harnesses, and carriages: others confine themselves to dressing skins, which are to be applied to binding books, and to other purposes requiring thin leather. It may be well to remark here, that the dressers of thin leather usually tan the skins themselves, using the leaves of sumach, instead of bark.

THE SHOE AND BOOT MAKER.

1. As the shoe is an article of primary utility, it was used, more or less, in the earliest ages. Some writers suppose, that the Deity, in clothing man with skins, did not leave him to go barefooted, but gave him shoes of the same material.

2. The shoes of the ancient Egyptians were made of the papyrus. The Chinese, as well as the inhabitants of India, and some other nations of antiquity, manufactured them from silk, rushes, linen, wood, the bark of trees, iron, brass, silver, and gold, and sometimes ornamented them with precious stones.

3. The Romans had various coverings for their feet; the chief of which were, *ceus* and the *solea*. The calceus it resembled the shoe we wear at nd was tied upon the instep with a latchet, or lace. The solea, or sandal, was a thick cork sole, covered above and beneath with leather, and neatly stitched on the edge: it left the upper part of the foot bare, and was fastened to it by means of straps, which were crossed over the instep, and wound about the ankle. Roman citizens wore the calceus with the toga, when they went abroad in the city; while the solea was worn at home, and on journeys. The solea was also used at entertainments; but it was changed for the calceus, when the guests were about to surround the table.

4. The senators wore shoes which came up to the middle of the leg, having a golden or silver crescent on the top of the foot. The shoes of the women were generally white, sometimes red, scarlet, or pur-

ple, and were adorned with embroidery and pearls; but those of the men were mostly black: on days of public ceremony, however, the magistrates wore red shoes.

5. Boots were used in very ancient times, and were, primarily, worn as a kind of armour, with a view of protecting the lower extremities in battle. They were, at first, made of leather, afterwards of brass or iron, and were proof against the thrusts and cuts of warlike weapons. The boot was called *ocrea* by the Romans, who, as well as the Greeks, used it in the army, and in riding on horseback, and sometimes in pedestrian journeys.

6. The fashion of boots and shoes, like every other part of dress, has been subject to a number of changes, both as regards their form and material. In Europe, about one thousand years ago, the greatest princes wore shoes with wooden soles. In the reign of William Rufus, of England, the shoes of the great had long, sharp points, stuffed with tow, and twisted like a ram's horn. The clergy preached against this fashion; but the points continued to increase in length, until the reign of Richard the Second, when they were tied to the knees with chains of silver, or gold. In the year 1463, Parliament interposed, and prohibited the manufacture or use of shoes or boots with *pikes* exceeding two inches in length.

7. Lasts adapted to each foot, commonly called *rights and lefts*, were not introduced into England until about the year 1785; nor was cramping, or *crimping*, the front part of boots, practised there for ten years after that period. These improvements did not become generally known, or, at least, were not much used, in the United States, for many years after their adoption in Great Britain.

8. Many facts, besides the preceding, might be adduced, to prove that the art of making shoes and boots, although uninterruptedly practised from the earliest ages, has received many important improvements within the last fifty years.

9. In Europe and America, boots and shoes are commonly made of leather: in shoes for females, however, it is not unusual to use prunello, which is a kind of twilled, worsted cloth. In all cases, thick leather is used for the soles.

10. The business of making boots and shoes is carried on very systematically, in large establishments. The materials are cut out and fitted by the foreman, or by the person who carries on the business; whilst the pieces are stitched together, and the work finished, by workmen who sit upon *the bench.*

11. As a matter of convenience, the trade have fixed upon certain sizes, which are designated by numbers; and, corresponding to these, the lasts are formed by the last-maker: but, to be still more exact, individuals sometimes procure lasts corresponding to their feet, on which they cause their boots and shoes to be made.

12. The following is a description of the process of making a leather shoe: after the materials have been cut out according to the measure, or size, and the parts of the *uppers* have been stitched together, the sole-leather is hammered on the *lap-stone*, tacked to the last, and trimmed with a knife: the upper leather is next stretched on the last with a pair of pincers, fastened to its proper place with tacks, and then sewed to the bottom of the sole with a waxed thread: a narrow strip of leather, called a *welt*, is also fastened to the sole by similar means, and to this is stitched another sole: a heel being added, the shoe is finished by trimming and polishing it with appropriate instruments.

13. The edges of fine leather shoes and boots, are trimmed with thin strips of the like material: whilst those of prunello, and other thin shoes for ladies, are bound with narrow tape. The binding is applied by females with thread, by means of a common needle.

14. Shoe-thread is commonly spun from flax: that from hemp is much stronger, and was formerly preferred; but it is now used only for very strong work. The greater part of the shoe-thread used in the United States, is spun by machinery, at Leeds, in England, from Russian flax. The wax employed by shoemakers, was formerly composed of tar and rosin; but it is now most usually made of pitch.

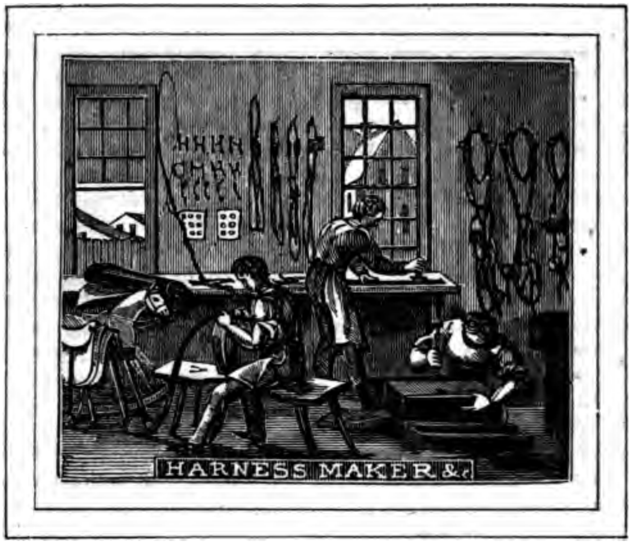
15. The shoemaker, in sewing together different parts of his work, uses threads of various sizes, which are composed of several small threads of different lengths: a hog's bristle is fastened to each end of it, which enables the workman to pass it with facility, through the holes made with the awl.

16. An expeditious way of fastening the soles of boots and shoes to the upper leathers, is found in the use of wooden pegs, or brass nails. The old method, however, is generally preferred, on several accounts; but chiefly, because the work is more durable, and because it can be more easily repaired.

17. Journeymen working at this trade most usually confine their labours to particular kinds of work, as few can follow every branch with advantage. Some make shoes and boots for men; others confine their labours to those designed for ladies: but, by their aid, the master-shoemaker can, and usually does, supply every kind at his store.

18. It is no uncommon thing in the country, for the farmers to purchase leather, and employ the shoemaker to make it up; and this is done, in most cases, on their own premises. The shoemaker employed in this way, removes from house to house, changing his location whenever he has completely served a whole family in his vocation. In such cases, he is said, by the trade, to be *whipping the cat.* The set of tools, with which he operates, is called his *kit.*

19. The shoemaker usually buys his leather from the tanner and the currier; and procures his tools, tacks, and various other articles of a similar nature, at the *finding stores.* In some cases, the shoemaker, with little or no capital, gets his materials from the *leather-cutter*, who makes it a business to supply them ready cut to the proper size and shape. There are, however, but few leather-cutters in our country; but, in England, this branch of trade is one of considerable importance, and is frequently connected with that of the leather-dresser.



THE SADDLER AND HARNESS-MAKER, AND THE TRUNK-MAKER.

THE SADDLER AND HARNESS-MAKER.

1. The invention of the saddle has been attributed to the Selians, a people of ancient Franconia. Under this impression, it has been supposed that the Latins gave it the name of *sella*. The period at which it was first used, cannot be ascertained: it is certain, however, that the horse had been rendered subservient to man, several centuries before this convenient article was thought of.

2. At first, the rider sat upon the bare back of the animal, and guided him with a switch, but afterward with a strap put round the nose. In the course of time, the rider came to use upon the back of the horse the skins of beasts, in order to render his seat more easy. The Greeks, and many other refined nations of antiquity, sometimes used superb trappings, composed of cloth, leather, and skins dressed with the hair on; and, in addition to the gold, silver, and precious stones, with which these were ornamented, the horses were often otherwise decked with bells, collars, and devices of various kinds.

3. The Romans, in the days of the Republic, deemed it more manly to ride on the bare back of the animal, than on coverings: at a later period, they used a kind of square pannel, without stirrups; and about the year 340 of the Christian era, they began to ride on saddles. It appears that those first employed were very heavy

as the Emperor Theodosius, in the same century, forbade the use of any which weighed over sixty pounds. The use of saddles was introduced in England by Henry the Seventh, who required all his subjects the custom of riding upon them.

4. The frame of a saddle is called a tree. It is not made by the saddlers, but by persons who confine their attention to this branch of business. The trees are constructed of wood, with a small quantity of iron, and covered with canvas.

5. In making a common saddle, the workman proceeds thus: he first extends the web, or strong girth web, from the pummel to the hinder part of the tree, and fastens them with tacks. The tree is then covered on the upper side with two thicknesses of linen cloth, between which a quantity of wool is afterwards interposed; a covering of thin leather, usually made of hog-skin, is next tacked on, and the flaps added. Under the whole are placed the pads and saddle-cloth; the former of which is made of thin cotton or linen cloth, and thin leather, stuffed with hair. The addition of four straps, two girths, two stirrup-leathers, and as many stirrups, completes the whole operation.

6. The roughness, or the little indentations on the flaps, are produced by passing the leather between rollers, in contact with a rough surface, or by beating it with a mallet, on the face of which has been fastened a piece of the skin from a species of shark, commonly called the dog-fish.

7. Saddles are often covered with buck-skin, commonly stitched into figures, and having the spaces between the seams stuffed with wool: this is particularly the case in side-saddles. The form of saddles,
ity of the materials, together
manship, are considerably
he purposes to which they are to be applied, and to accommodate the fancy of customers.

8. The process of making bridles and harness for horses, is extremely simple. The leather is first cut out with a knife of some description, but usually with one of a crescent-like form, or with a blade set in a gauge, and then stitched together with the kind of thread used by shoemakers. The awl employed in punching the holes is straight; and needles are most commonly used, instead of the bristles which point the shoemaker's threads. The mode of manufacturing saddle-bags, portmanteaus, and valises, is too obvious to need description.

THE TRUNK-MAKER.

1. The manufacture of trunks is equally simple with that of harness. In common cases, it consists chiefly in lining the inside of a box with paper, or some kind of cloth, and covering the outside with a skin, or with leather, which is fastened to the wood by means of tacks. Narrow strips of leather are fastened upon hair trunks with brass nails, by way of ornament, as well as to confine the work.

2. Instead of a wooden box, frames of iron are used for the best kinds of trunks: in such cases, thick sole-leather is applied to every side, and the whole is covered with well-dressed calf-skin. In the manufacture of trunks of this description, but few tacks and brass nails are used, the leather being fastened to its place with seams of waxed thread.

3. How long trunk-making has been a separate trade, cannot be exactly ascertained. The trunk-makers in France were incorporated into a company, in 1596. In the United States, this branch of business is very commonly united with that of the saddler and harness-maker.

THE SOAP-BOILER, AND THE CANDLE-MAKER.

THE SOAP-BOILER.

1. The business of the soap-boiler consists in manufacturing soap, by the combination of certain oily and alkaline substances.

2. The earliest notice of this useful article occurs in the works of Pliny, in which it is stated that soap was composed of tallow and ashes; that the mode of combining them was discovered by the Gauls; but that the German soap was the best.

3. For many ages before the invention of soap, saponaceous plants, and several kinds of earth, together with animal matters and the ley from ashes, were employed for the purpose of cleansing the skin, and articles of clothing. The idea of combining some of these substances, with the view of forming soap, probably originated in accident.

4. The vegetable oils and animal fats, capable of saponification, are very numerous; but those most commonly employed in the manufacture of the soaps of commerce, are olive-oil, whale-oil, tallow, lard, palm-oil, and rosin; and the alkalies with which these are most frequently combined, are soda, the ley of ashes, or its residuum potash.

5. Soda is sometimes called the *mineral alkali*, because it is found, in some parts of the world, in the earth. It was known to the ancients, at a very early period, under the denomination of *natron:* it received this appellation from the lakes of Natr

in Egypt, from the waters of which it was procured by evaporation during the summer season.

6. The soda of commerce is now chiefly obtained from the salsola, a genus of plants which grows on the sea-shore. In Spain, the plant from which soda is obtained is denominated *barilla*; hence, the substance procured from it by incineration has received the same appellation. The ashes of a sea-weed which grows on the coasts of Scotland and Ireland, is called *kelp*. In Europe, barilla and kelp are more extensively employed in the manufacture of soap than any other alkaline substances; but in this country, where wood is so much used for fuel, common ashes are generally preferred.

7. The process of making the ordinary brown or yellow soap, from wood-ashes, is conducted in the following manner: the alkali is first obtained in a state of solution in water, by leaching the ashes as described in page [illegible], and then poured, in a weak state, into a copper or iron cauldron, having a large furnace and chimney affixed to the bottom.

8. When the ley has been properly heated, the tallow, either in a fluid state, or otherwise, is gradually added. More ley, of greater concentration, is poured in; and the ingredients are moderately boiled for several hours, while a person, as represented in the preceding cut, aids their chemical union by agitating them with a wooden spatula.

9. After a quantity of resin has been added, and properly incorporated with the other materials, the fire is withdrawn until the mass ceases boiling, when it is again raised: then, with the view of forming the paste into hard soap, a quantity of muriate of soda (common salt) is added: the muriatic acid of this substance uniting with the potash, forms with it muriate of potash, which dissolves in the water, while the soda combines with the tallow and rosin. Hard soap, therefore, contains no potash; although this alkali is generally employed during the early part of the process of making it.

10. After the addition of the muriate of soda, the boiling and stirring are continued two or three hours, when the fire is withdrawn, and the contents of the cauldron are suffered to be at rest. When the soap has completely separated from the watery part, and extraneous matters, it is laded into another cauldron, again diluted with strong ley, and heated. The *paste* having been brought to a proper consistence, more common salt is added as before, and for the same purpose.

11. The chemical part of the process having been thus completed, the soap is laded into single wooden boxes, or into one or more composed of several distinct frames, which can be removed separately from the soap, after it has become solid enough to stand without such support. The soap is cut into bars, of nearly a uniform size, by means of a small brass wire.

12. Manufacturers of soap have contrived various methods of adulterating this article, or of adding ingredients which increase its weight, without adding to its value. The most common means employed for this purpose is water, which may be added, in some cases, in considerable quantities, without greatly diminishing the consistency of the soap.

13. This fraud may be detected by letting the soap lie for some time exposed to the atmosphere: the water will thus be evaporated, and its quantity can be known by weighing the soap, after its loss of the superfluous liquid. To prevent evaporation while the soap remains on hand, it is

said that some dealers keep it in saturated solutions of common salt. Another method of adulteration is found in the use of pulverized lime, gypsum, or pipe-clay: these substances, however, can be easily detected by means of a solution in alcohol, which precipitates them.

14. The process of manufacturing soft soap, differs but little in its details from that described in the preceding paragraphs. The chief difference consists in omitting the use of salt: soft soap, therefore, is composed of a greater proportion of water, and more alkali than is necessary to saturate the unctuous matters. Soft soap is made by almost every family in the country, from ashes, grease, and oily matters, reserved for the purpose.

15. The celebrated Marseilles white soap, is composed of

Soda,	6.
Olive-oil,	60.
Water,	34.

Castile soap, of

Soda,	9.
Olive-oil,	76.5
Water, with a little colouring matter,	14.5

Fine toilet-soaps are made with oil of almonds, nut-oil, palm-oil, suet, or butter: they are either potash or soda soaps, as they may be prepared in a solid or pasty state.

16. In the manufacture of white soap, the tallow is more carefully purified, and no rosin is used: in other particulars, the process differs but little from that employed in the production of the common kind. Two tons of tallow should yield three tons of white soap. In making the same quantity of common brown or yellow soap, twelve hundred weight less is required, on account of the substitution of that amount of yellow rosin.

17. The mottled appearance of some soaps is caused by dispersing the ley through it, towards the close of the operation; or by adding a quantity of sulphate of iron, indigo, or the oxide of manganese. Castile soap, now manufactured in the greatest perfection at Marseilles, in France, receives its beautifully marbled appearance from the sulphate of iron.

THE CANDLE-MAKER.

1. The subject of the candle-maker's labours may be defined to be a wick, covered with tallow, wax, or spermaceti, in a cylindrical form, which serves, when lighted, for the illumination of objects in the absence of the sun. The business of candle-making is divided into two branches: the one is confined to the manufacturing of tallow candles, and the other to making those composed of wax or spermaceti.

2. The process of making candles from tallow, as conducted by the tallow-chandler, needs only a brief description, since it differs but little from the method pursued by families in the country, with which most persons are familiar: the difference is chiefly in the employment of a few conveniences, by which the candles are more rapidly multiplied.

3. The first part of the process consists in preparing a wick, to serve as a foundation. The coarse and slightly twisted yarn used for this purpose, is spun in the cotton-factories; and, being wound into balls, is, in that form, sold to the tallow-chandlers, as well as to individuals who make candles for their own consumption.

4. A sufficient number of threads is combined, to form a wick of a proper size: and, as they are wound from the balls, t
are measured off, and cut to the pr

length, by a simple contrivance, which consists of a narrow board, a wooden pin, and the blade of a razor: the pin and razor are placed perpendicularly to the board, at a distance determined by the length of the proposed wick. The wicks are next put upon cylindrical rods, about three feet long; and a great number of these are arranged on a long frame.

5. To obtain the tallow in a proper state for use, it is separated from the membranous part of the suet, by boiling the latter in an iron or copper kettle, and then subjecting the *cracklings* to the action of a press. The substance that remains, after the tallow has been expressed, is called *greaves*, which are sometimes applied to fattening ducks for market: this is especially the case in the city of London.

6. The *tried* tallow is prepared for application to the wicks, by heating it to a proper temperature: it is then poured into a suitable receptacle, where it is kept in *order* either by a moderate fire underneath, or by the occasional addition of hot tallow.

7. The *broaches*, as the sticks with their wicks are called, are taken up, several at a time, either between the fingers or by means of a simple instrument denominated a *rake*, and dipped into the tallow: they are then returned to the frame, and suffered to cool, while successive broaches are treated in the same way. The dipping is repeated until the candles have been thickened to the proper size.

8. In the preceding plate is represented a workman in the act of dipping several broaches of candles, suspended on a rake, which he holds in his hands. The mode of making dipped candles just described, is more generally practised than any other, and in this manner five or six hundred pounds can be made by one hand, in a single day. In some establishments, however, a more complicated apparatus is used, by which every part of the process is greatly expedited.

9. Mould candles are made very differently. The moulds consist of a frame of wood, in which are arranged several hollow cylinders, generally made of pewter: at the lower extremity of each cylinder, is a small hole, for the passage of the wick, which is introduced by means of a hook on the end of a wire. The cotton is fastened at the other end, and placed in a perpendicular situation in the centre of the shafts, by means of a wire, which passes through the loops of the wicks. The melted tallow, having been poured on the top of the wooden frame, descends into each mould; and after the candles have become sufficiently cold, they are extracted from the cylinders with a bodkin, which is inserted into the loop of the wick. One person can thus mould two or three hundred pounds in a day.

10. Candles are also made of bees-wax and spermaceti; but the mode of their manufacture differs in no particular from that of common mould candles. The wicks for wax-candles are usually made of a peculiar kind of cotton, which grows in Asiatic Turkey.

11. Before the wax is applied to this purpose, the colouring matter is discharged. This is effected by bleaching the wax, in the following manner: it is first divided into flakes, or thin laminæ, by pouring it, in a melted state, through a colander upon a cylindrical wheel, which, at the same time, is kept revolving, while partly immersed in cold water: the wax, having been removed from the water, is placed upon a table or floor covered with some kind of cloth: here it is occasionally sprinkled with water, until the bleaching has been completed. The process occupies

several weeks, or even months, according to the state of the weather, that being best which is most favourable to a rapid evaporation.

12. Spermaceti is a substance separated from sperm-oil, which is obtained from a species of whale, called *physeter macrocephalus*, or *spermaceti cachalot*. This oil is obtained both from the head and body of the animal, but that procured from the former contains twice the quantity of spermaceti.

13. To separate the spermaceti from the oil yielded by the body, it is first heated, then put into casks, and suffered to stand two or three weeks, in order to *granulate:* the oily part is now filtrated through strainers; and the remainder, which is called *foots*, is again heated, and put into casks: after standing several weeks, these are put into bags, and submitted to the action of a powerful press. The spermaceti, thus obtained, is melted and moulded into cakes. The oil thus separated from the spermaceti is called spring or fall strained, because it is filtered and expressed only during those seasons of the year.

14. The oil from the head of the whale is treated like that from the body, in almost every particular: the difference consists, principally, in omitting the use of the strainer, and in the employment of stronger bags and a more powerful press. The oil obtained from the *head-matter* is called *pressed*, since it is separated by the action of the press only: it is also denominated *winter-strained*, because the operation is performed in the cold weather.

15. The spermaceti, having been melted and moulded into cakes, is reserved until the succeeding summer, when it is cut into thin shavings, by means of a large shave, similar to the *spoke-shave* of the wheelwrights, and again pressed as before. The oil of this last pressing is called *taut pressed*, and is the least valuable kind, since a slight degree of cold causes it to become thick. The spermaceti obtained from the common sperm-oil, and that from the head-matter, are melted together, and purified by means of potash-ley.

16. The sperm-oil, thus freed from the spermaceti, is extensively applied in lamps as a means of illumination; and, for many purposes, it is far more convenient than tallow. In the country, lard is frequently employed instead of oil, especially by the German population. In some European and Asiatic countries, vegetable oils supply the place of animal fats, in this application.

17. The origin of the art of making candles, is not known. It is evident, however, that the business is comparatively modern, since the Greeks and Romans, as well as other nations of antiquity, employed torches of pine and fir, and lamps supplied with oil, in the production of artificial light. The words in the scriptures, translated *candle*, imply nothing more nor less than a light produced by some kind of oil consumed in a lamp.

18. The lamps in ancient times were suspended by a chain or cord from the ceiling, or supported on stands and moveable tables, which were called by the Romans *lampadaria*, or *candelabra*. Many specimens of this utensil are preserved in several museums of Europe, and some have lately been found in the ruins of Herculaneum.

19. The Chinese make their candles from the tallow obtained from the seeds and capsules of the tallow-tree. This tree, which is produced in great abundance in China, is said to be cultivated in various parts of South Carolina and Georgia. In appearance, it resembles the Lombardy poplar.

THE COMB-MAKER, AND THE BRUSH-MAKER.

THE COMB-MAKER.

1. The comb is a well-known instrument, employed in cleansing, dressing, and confining the hair. It is made of various materials, but most commonly of tortoise-shell, the horns and hoofs of cattle, ivory, bone, and several kinds of hard wood.

2. It is impossible to determine the period of the world at which it was introduced, since history and tradition, the sources from which we obtain information of this nature, are silent with regard to its origin. It is evident, however, that the comb is an instrument of primary necessity; and hence it must have been invented in the earliest ages. This opinion is confirmed by the fact, that the comb has been frequently found in use amongst savages, when first visited by civilized men.

3. Combs employed in fixing the hair, are made of tortoise-shell, or of the horns of cattle. The genuine tortoise-shell is taken from the *testudo imbricata*, or *hawk's-bill turtle;* but a kind of shell, inferior in quality, is obtained from the *testudo caretta*, or *loggerhead turtle.* These turtles inhabit the seas of warm and temperate climates; but they are especially numerous in the West Indian seas, where *shell* is a valuable article of commerce: that from St. Domingo is especially esteemed, for its brilliancy of shade and colour.

4. The shell of the hawk's-bill turtle was extensively employed for ornamental purposes by the refined nations of antiquity, although we have no account of its application to the manufacture of combs. The Greeks and Romans decorated with it the

doors and pillars of their houses, as well as their beds and other furniture. The Egyptians dealt largely with the Romans, in this elegant article.

5. The general length of the hawk's-bill turtle is about three feet from the bill to the end of the shell; but it has been known to measure five feet, and to weigh five or six hundred pounds: in the Indian ocean, especially, specimens of prodigious magnitude are said to have occurred.

6. The shell employed in the arts grows upon the back and feet of the animal: that on the back, consists of thirteen laminæ, or plates, which lap over each other, like tiles on the roof of a house. The plates vary in thickness from one-eighth to one-fourth of an inch; according to the age and size of the turtle. The quantity of merchantable shell obtained from a single subject of the usual size, is about eight pounds, which, at the usual price, is worth sixty or seventy dollars.

7. The process of making combs from the horns of cattle, is not difficult to be understood. The tips and buts are first cut off with a saw, and the remaining portion is also divided longitudinally on one side with the same instrument. The horns are then soaked for the space of several days, and afterwards boiled in oil, to render them pliable: they are next spread out and pressed between hot iron plates. This operation clarifies the horn, and produces a plate of proper thickness.

8. After the plates thus produced have been cut to the sizes of the proposed combs, and when these have been shaved to a suitable thickness with instruments adapted to the purpose, the teeth are cut either with a *twinning saw*, as represented in the preceding cut, or with a *twinning machine*.

9. In the former case, the plate is fastened with a wooden *clamp*, by the part which is designed to be left for the back of the comb; and when twins, or two combs, are to be formed from one piece, the other end is bent down, so as to render the upper surface considerably convex: to this surface the *twinning saw* is applied by the hand of the workman, who makes a number of incisions; which are completed both ways with two different kinds of saws, and the end of each tooth is cut from the back of the opposite comb with an instrument called a *plugging awl*.

10. The *twinning machine* was invented about fifteen years ago, by a Mr. Thomas, of Philadelphia; but it has been successively improved by several individuals since that time. It is, altogether, an ingenious and useful contrivance. The cutting part consists of two chisels, which are made to act on the plate alternately, and in a perpendicular direction, each chisel cutting one side of two teeth, and severing one from the opposite back, at every stroke. It is impossible, however, to form a clear conception of the manner in which the machine operates, except by actual inspection. It performs the work with great rapidity, since from one to two hundred dozens of combs can be cut in twelve hours; whereas, not one-fourth of that number can be *twinned*, in the old method, during the same time.

11. After the teeth have been rounded and in other respects brought to the proper form with suitable instruments, the combs are polished by rubbing them first with the dust of a peculiar kind of brick, then by applying them to a moving cylinder covered with buff leather, charged with rotten-stone, ashes, or brick-dust; and finally, by rubbing them with the hand, charged with rotten-stone and vinegar.

12. The combs are next coloured

stained; and, as the tortoise-shell is by far the best and most expensive material for this kind of comb, the great object of the manufacturer is to produce colours as nearly resembling those of the real shell as practicable. This is done in considerable perfection, in the following manner:

13. The combs are first dipped in aquafortis, and then covered with a paste made of lime, pearl-ash, and red lead. To produce the requisite variety of shades, both taste and judgment are necessary in applying the composition, and in determining the time which it should remain upon the combs. To give the combs a still stronger resemblance to shell, they are also immersed for fifteen or twenty minutes in a dye of nicaragua.

14. The combs having been covered with oil, they are next heated upon iron plates, and brought to the desired shape by bending them upon wooden blocks with a woollen list. The whole process is finished by rubbing off the oil with a silk handkerchief.

15. The general process of making shell combs differs but little from that which has been just described, varying only in a few particulars, in compliance with the peculiar nature of the material.

16. On account of the great value of shell, the workmen are careful to make the most of every portion of it: accordingly, when a piece falls short of the desired size, it is enlarged by *welding* to it another of smaller dimensions. The union is effected, by lapping the two pieces upon each other, and then pressing them together between two plates of hot iron: the heat of the iron is prevented from injuring the shell, by the interposition of a wet linen cloth, and by immersing the whole in hot water. In a similar manner, broken combs are often mended; and by the same method, two pieces of horn can also be joined together.

17. Both horn and shell combs are often stamped with figures, and otherwise ornamented with carved work. In the latter case, the ornaments are produced, by removing a part of the material with a saw and graver. The saw employed is not more than the twelfth of an inch in width, and being fastened to a frame, is moved up and down, with great rapidity, by means of the foot, while the part of the comb to be cut away is applied to the teeth. The operator is guided in the work by a pattern, which has been struck on paper from an engraved plate.

18. Combs for dressing and cleansing the hair, are made of horn, shell, bone, ivory, and wood; but it is unnecessary to be particular in describing the manner in which every kind of comb is manufactured: we will only add, the teeth of fine ivory and bone combs are cut with a buzz, or circular saw, which, fastened to a mandrel, is moved in a lathe.

THE BRUSH-MAKER.

1. There are few manufactured articles in more general use, than brushes. This has arisen from their great utility, and the low prices at which they can be purchased. The productions of the brush-maker's labour are denominated variously, according to the purposes to which they are to be applied.

2. The operations connected with this business are very simple, as there is scarcely a tool employed which is not familiar to every other class of mechanics. The brush-maker, however, does not manufacture every part of the brush. He procures his wooden *stocks* and handles from various sources, but chiefly from the turner; and

bone handles, from the tooth-brush handle-maker.

3. The first part of the process which may be considered as belonging particularly to the brush-maker, consists in boring the holes for the reception of the bristles: this is done with a *bit* of a proper size, which is kept in motion with a lathe, while the wood is brought against it with both hands. To enable the operator to make the holes in the right place, and in the proper direction, a pattern is applied to the hither side of the stock.

4. The greater part of the bristles used by the brush-makers in the United States, are imported from Russia and Germany: large quantities, however, are obtained from Pennsylvania, and some parts of the Western States. American bristles are worth from thirty to fifty cents per pound, a price sufficiently high, one would suppose, to induce the farmers to preserve them, when they butcher their swine: were this generally done, a tolerable supply of the shorter kinds of bristles might be obtained in our own country.

5. When the bristles come into the hands of the brush-maker, the long and short, and frequently those of different colours, are mixed together. These are first assorted, according to colour, and those of a whitish hue are afterwards washed with potash-ley and soap, to free them from animal fat, and then whitened by bleaching them with the fumes of brimstone.

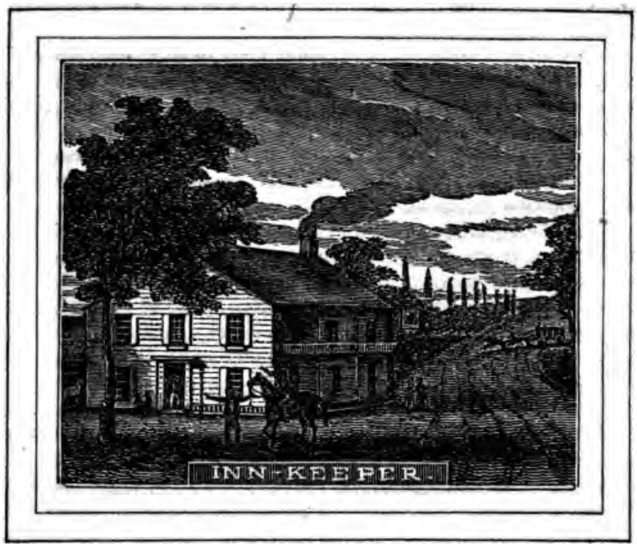
6. The bristles are next combed with a row of steel teeth, for the purpose of placing them in a parallel direction, and with a view of depriving them of the short hair which may be intermixed. The workman, immediately after combing a handful, assorts it into separate parcels of different lengths. This is very readily done, by pulling out the longest bristles from the top, until those which remain in the hand have been reduced to a certain length, which is determined by a gauge marked with numbers. At each pulling, the handful is reduced in height near half an inch.

7. The stocks and the bristles having been thus prepared, they are next fastened together: this is effected, either with wire or a composition of tar and rosin. The wire is used in all cases in which the fibre is doubled; but when the bristles are required in their full length, as in sweeping-brushes, the adhesive substance is employed.

8. It is superfluous to enter into detail, to show the manner in which the wire and composition are applied, in fixing the bristles, as any person, with an ordinary degree of observation, can readily comprehend the whole, by examining the different kinds of brushes which are met with in every well-regulated household. The bristles, after having been fixed to the stock or handle, are trimmed with the shears or knife, according as they are required to be equal or unequal in length.

9. The brush is next handed over to the *finisher*, who applies to the back of the stock a thin veneer of wood, which secures the wire against the oxidizing influence of the atmosphere, and gives to the brush a finished appearance. The stock, together with the veneer, is then brought to the desired shape with suitable instruments, polished with sand-paper, and covered with varnish.

10. Those brushes which the manufacturer designs to be ornamented, are sent in great quantities to the *ornamenter*, who applies to them various figures, in gold or Dutch leaf, japan or bronze, and sometimes prints, which have been struck on paper from engraved plates.



THE TAVERN-KEEPER.

1. A HOUSE in which travellers are entertained is denominated a tavern, inn, coffee-house, hotel, or house of public entertainment; and an individual who keeps a house of this description, is called an inn-keeper or tavern-keeper. Of these establishments there are various grades,—from the log cabin with a single room, to the splendid and commodious edifice with more than a hundred chambers.

2. This business is one of great public utility; since, by this means, travellers obtain necessary refreshments and a temporary home, with very little trouble on their part; and that, in most cases, for a reasonable compensation. This is especially the case in the United States, where the public houses, taking them together, are said to be superior to those of any other country.

3. Travellers, in the early ages of the world, either carried with them the means of sustenance and protection from the weather, or relied upon the hospitality of strangers; but, as the intercourse between different places, for the purposes of trade, increased, houses of public entertainment were established, which at first were chiefly kept by women.

4. The people of antiquity, in every age and nation, whether barbarous or civilized, were, however, remarkable for their hospitality. We find this virtue enjoined in the Mosaic writings, and scriptures generally, in the poems of Homer, as well as in other distinguished writings, which have

descended to our times. The heathen nations were rendered more observant of the rites of hospitality, by the belief, that their fabulous gods sometimes appeared on earth in human shape; and the Jews and ancient Christians, by the circumstance that Abraham entertained angels unawares.

5. On account of the occasional acts of violence committed both by the guests and master of the house, it became necessary to take some precautions for their mutual safety. When, therefore, a stranger applied for lodgings, it was customary among the Greeks for both to swear by Jupiter that they would do each other no harm. This ceremony took place while each party stood with his foot placed on his own side of the threshold; and a violation of this oath by either party, excited against the offender the greatest horror.

6. The Greeks and Romans, in common with the people of many other nations, were in the habit of making arrangements with persons at a distance from their homes, for a mutual accommodation, when either party might be in the vicinity of the other. In these agreements, the contracting parties included their posterity, and delivered to each other tokens, which might be afterwards exhibited in proof of ancient ties of hospitality between the families. They swore fidelity to each other by the name of Jupiter, who was surnamed the hospitable, because he was supposed to be the protector of strangers, and the avenger of their wrongs.

7. This relation was considered a very intimate one, especially by the Romans; and, in their language, it was called *hospitium*, or *jus hospitii:* hence, the guest and entertainer were both called *hostes*, a word from which *host* is derived, which is employed to designate both the landlord and the guest. The Roman nobility used to build, for the reception of strangers, apartments called *hospitalia*, on the right and left of the main building of their residence.

8. During the middle ages, also, hospitality was very commonly practised; and the virtue was not considered one of those which might be observed or neglected, at pleasure: the practice of it was even enjoined by statute, in many countries, as a positive duty, which could not be neglected with impunity. In some cases, the moveable goods of the inhospitable person were confiscated, and his house burned. If an individual had not the means of entertaining his guest, he was permitted to steal, in order to obtain the requisite supply.

9. The nobles of Europe, during this period, were generally distinguished for their cordial entertainment of strangers, and their immediate adherents. Their extraordinary liberality arose, in part, from the general customs of the age, and partly from a desire to attach to their interests as great a number of retainers as possible, with a view to maintain or increase their political importance Strangers were also entertained at the monasteries, which were numerous in almost every kingdom of Europe. Several of these institutions were established in solitary places, with the express purpose of relieving travellers in distress.

10. It is evident, that the arrangements for mutual accommodation, and the hospitable character of the ancients, were unfavourable to the business of keeping tavern: but the free intercourse between different nations, which arose from the Crusades, and the revival of commerce, contributed greatly to the habit of regularly entertaining strangers for a compensation, and led to the general establishmer of inns.

11. These inns, however, were not, at first, well supported, for the reason, that travellers had been so long accustomed to seek for lodgings in private houses. In Scotland, inns were established by law, A. D. 1424; and, to compel travellers to resort to them, they were forbidden, under a penalty of forty shillings, to use private accommodations, where these public houses were to be found.

12. How far legislative enactments have been employed for the establishment of inns in other countries, we have not been able to learn, as the authorities to which we have referred for information on this point are silent with regard to it: we know, however, that laws have been made in almost every part of Europe, as well as in the United States, with the view of compelling the landlord to preserve proper order, and to accommodate his customers at reasonable charges.

13. In the United States, and in all other commercial countries, this business has become an employment of great importance, both to the individuals who have engaged in it, and to the general community. Within the present century, the amount of travelling has greatly increased, and the excellence of the public houses has advanced in the same ratio. Some of these establishments, in the cities and large towns, are among the most extensive and splendid edifices of the country; and, in every place through which there is much travelling, they are usually equal, or superior, to the private dwellings of the neighbourhood.

14. The business of keeping tavern, however, is not always confined to the proper object of entertaining travellers, or persons at some distance from home. A public house is frequently the resort of the people who live in the immediate vicinity, and is often the means of doing much injury, by increasing dissipation.

15. In all cases in which ardent spirits are proposed to be sold, a license must be obtained from the public authorities, for which must be paid the sum stipulated by law; but any person is permitted to lodge travellers, and to supply them with every necessary means of cheer and comfort for a compensation, without the formality of a legal permission: yet, a license to sell liquors is called a tavern-license, because most tavern-keepers regard the profits on the sale of ardent spirits as one of their chief objects.

16. A public house in which no strong drink is sold, is called a temperance tavern; and such establishments are becoming common: but they are not, at present, so well supported as those in which the popular appetite is more thoroughly complied with. The time, however, may not be far distant, when the public sentiment will undergo such a salutary change, that the tavern-keepers generally will find it their best policy to relinquish the sale of this poisonous article.

17. As travellers often apply to the bar for "something to drink," merely to remunerate the landlord for the use of his fire, or some little attention, the friends of temperance would essentially promote their cause, by encouraging the practice of paying for a glass of water, or some trifle of this kind: this would increase the number of temperance taverns, and, perhaps, be the means of preventing many generous people from forming those dissipated habits, which are so often attended with ruinous results.

THE HUNTER.

1. Hunting and fishing are usually considered the primary occupations of man; not because they were the first employments in which he engaged, but because they are the chief means of human sustenance among savage nations.

2. The great and rapid increase of the inferior animals, and, probably, the diminished fertility of the soil after the deluge, caused many branches of the family of Noah to forsake the arts of civilized life, especially after the dispersion caused by the confusion of tongues.

3. Many of these families, or tribes, continued in this barbarous state for several ages, or until their increase of numbers, and the diminished quantity of wild game, rendered a supply of food from the objects of the chase extremely precarious. Necessity then compelled them to resort to the domestication of certain animals, and to the cultivation of the soil. But the practice of hunting wild animals is not confined to the savage state: it is an amusement prompted by a propensity inherent in human nature.

4. The earliest historical notice of this sport is found in the tenth chapter of Genesis, in which Nimrod is styled, "a mighty hunter before the Lord." So great was his prowess in this absorbing pursuit, that he was proverbially celebrated on this account even in the time of Moses. Nimrod is the first king of whom we read in history; and it is by no means improbable, that his skill and intrepidity in subduing the wild beasts of the forest, contributed larg towards elevating him to the regal stati

5. Although the spoils of the chase are of little consequence to men, after they have united in regular communities, in which the arts of civilized life are cultivated; yet the propensity to hunt wild animals continues, and displays itself more or less among all classes of men.

6. The reader of English history will recollect that William the Conqueror, who began his reign in the year 1066, signalized his passion for this amusement, by laying waste, and converting into one vast hunting-ground, the entire county of Hampshire, containing, at that time, no less than twenty-two populous parishes. Severe laws were also enacted, prohibiting the destruction of certain kinds of game, except by a few persons having specified qualifications. With some modifications, these laws are still in force in Great Britain.

7. In other countries of Europe, also, large tracts have been appropriated by the kings and nobles to the same object. This tyrannical monopoly is attempted to be justified by the unreasonable pretension, that all wild animals belong, of right, to the monarch of the country where they roam.

8. The quadrupeds most hunted in Europe, are the stag, the hare, the fox, the wolf, and the wild boar. These beasts are pursued either on account of their intrinsic value, or for sport, or to rid the country of their depredations: in some instances, all three of these objects may be united. The method of capturing or killing the animals is various, according to the character and objects of the persons engaged in it.

9. In Asia, the wolf is sometimes hunted with the eagle; but, in Europe, the strongest greyhounds are employed to run him down: this task, however, is one of extreme difficulty, as he can easily run twenty miles upon a stretch, and is besides very ning in the means of eluding his pursuers. Chasing the fox on horseback, with a pack of hounds, is considered an animating and manly sport, both in Europe and North America.

10. The most prominent victim of the hunter, in Africa, is the lion. He is usually sought in small parties on horseback with dogs; but sometimes, when one of these formidable animals has been discovered, the people of the neighbourhood assemble and encircle him in a ring, three or four miles in circumference: the circle is gradually contracted, until the hunters have approached sufficiently near to the beast, when they dispatch him, usually with a musket-ball.

11. In the southern parts of Asia, tiger-hunting is a favourite amusement. Seated upon an elephant, trained especially for the purpose, the hunter is in comparative safety, while he pursues and fires upon the tiger until his destruction is effected.

12. The white bear and the grisly bear are the most formidable animals in North America; yet they are industriously hunted, both by Indians and white men, on account of the value of their flesh and skins. Bisons, or, as they are erroneously called, buffaloes, are found in great numbers in the vast prairies which occur between the Mississippi and the Rocky Mountains. They are commonly met with in droves, which sometimes amount to several thousands.

13. When the Indian hunters propose to destroy these animals, they ride into the midst of a herd, and dispatch them with repeated wounds; or, they get a drove between themselves and a precipice, and, by shouting and yelling, cause the animals to crowd each other off upon the rocks below. In this manner, great numbers are disabled and taken at once. The hunters, at other times, drive the bisons into inclosures, and

then shoot them down at their leisure. The hide of this animal is dressed with the hair adhering to it; and skins in this state are used by the savages for beds, and by the white people, in wagons, sleighs, and stages.

14. North America, and the northern parts of Asia, have been, and, in some parts, still are, well stocked with fur-clad animals; and these are the principal objects of pursuit, with those who make hunting their regular business. Some of these animals were common in every part of North America, when this portion of the western continent was first visited by Europeans; and a trade in peltries, more or less extensive, has been carried on with the natives, ever since the first settlement of the country.

15. For the purpose of conducting this trade with advantage, a company was formed in England, in 1670, by Prince Rupert and others, to whom a charter was granted, securing to them the exclusive privilege of trading with the Indians about Hudson's Bay. Another company was formed in 1783–4, called the North-West Fur Company. Between these companies, there soon arose dissensions and hostilities, and many injuries were mutually inflicted by the adherents of the parties. Both associations, however, were at length united, under the title of the Hudson's Bay Fur Company. The Indian trade, on the great lakes, and the Upper Mississippi, has long been in possession of the North American Fur Company, most of the directors of which reside in the city of New York.

16. The companies just mentioned supply the Indians with coarse blue, red, and fine scarlet cloths, coarse cottons, blankets, ribands, beads, kettles, fire-arms, hatchets, knives, ammunition, and other articles adapted to the wants of the hunters; receiving, in return, the skins of the musk-rat, beaver, otter, martin, bear, deer, lynx, fox, &c.

17. The intercourse with the Indians is managed by agents, called clerks, who receive from the company a salary, ranging from three to eight hundred dollars per annum. The merchandise is conveyed to the place of trade, in the autumn, by the aid of Canadian boatmen and half-Indians. The most considerable portion of the goods are sold to the Indians on a credit, with the understanding that they are to make payment in the following spring; but, as many neglect this duty, a high price is affixed to the articles thus intrusted to savage honesty. The clerk furnishes the debtor with a trap having his own name stamped upon it, to show that the hunter has pledged every thing which may be caught in it.

18. Each clerk is supplied with four labourers, and an interpreter; the latter attends to the store in the absence of the clerk, or watches the debtors in the Indian camp, lest they again sell the produce of their winter's labours. The peltries, when obtained, are sent to the general agent of the company.

19. The fur trade is also prosecuted, to some extent, by a class of men in Missouri, who proceed from the city of St. Louis, in bodies comprising from fifty to two hundred individuals. After having ascended the Missouri river, or some of its branches, and, perhaps, after having passed the Rocky Mountains, they separate, and pursue the different animals on their own individual account, either alone or in small parties. The Indians regard these men as intruders on their territories; and, when a favourable opportunity is presented, they fr

quently surprise and murder the wandering hunters, and retain possession of their property.

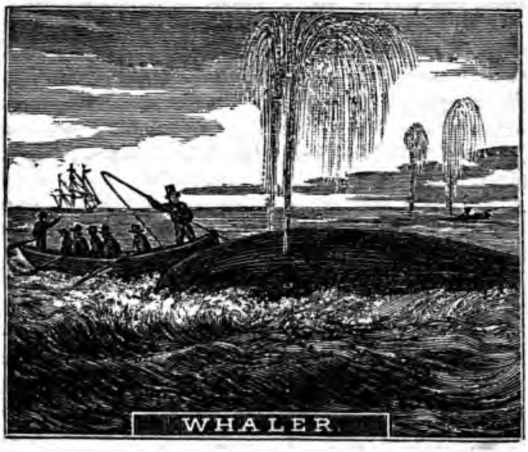
20. In consequence of the unremitted warfare which has, for a long time, been carried on against the wild animals of North America, their number has been greatly diminished; and, in many parts, almost every species of the larger quadrupeds and the fur-clad animals has been exterminated. Even on the Mississippi, and the great lakes, the latter description of animals has been so much reduced in number, that the trade in peltries, in those parts, has become of little value. Another half century will, probably, nearly terminate the trade, in every part of North America.

21. The fur trade was prosecuted with considerable success, during the latter part of the last century, principally by the English, on the north-west coast of America, and the adjacent islands. The peltries obtained by these enterprising traders, were carried directly to China. The trade was interrupted for a while by the Spaniards, who laid claim to those regions, and seized the British traders engaged there, together with the property in their possession. This affair, however, was afterwards amicably adjusted by the Spanish and English governments; and the whole trade, from California north, and to China, was opened to the latter.

22. The fur trade, in those parts, is now chiefly in the hands of the Russian Company in America, which has a capital of a million of dollars engaged in the business. Most of the persons owning the stock are merchants, residing at Irkutsk, a town of Siberia, which is the centre of the fur trade of that country. The skins obtained in Russian America are chiefly procured from the sea-otter, and several species of seal, together with those from foxes, of a blue, black, and gray colour, which are brought from the interior. Parties of Russian hunters have already passed the Rocky Mountains, and interfered with the trade of the Hudson's Bay Company. The fur trade of Siberia is chiefly carried on with China.

23. The chief objects of the hunters in Siberia, are the black fox, the sable, the ermine, the squirrel, the beaver, and the lynx. In the region near the Frozen Ocean, are also caught blue and white foxes. Siberia is the place of banishment for the Russian empire; and the exiles were formerly required to pay to the government an annual tribute of a certain number of sable-skins. The conquered tribes in Siberia, were also compelled to pay their taxes in the skins of the fox and sable; but now, those of less value, or money, are frequently substituted.

24. Although the skins of beasts were the first means employed to clothe the human body, yet it does not appear that the Greeks and Romans, and the other refined nations of antiquity, ever made use of furs for this purpose. The custom of wearing them, originated in those regions where the fur-clad animals were numerous, and where the severity of the climate required this species of clothing. The use of furs was introduced into the southern parts of Europe by the Goths, Vandals, Huns, and other barbarous nations, which overran the Roman empire.



WHALER.

THE FISHERMAN.

1. ALTHOUGH permission was given by the Deity, immediately after the flood, to employ for human sustenance "every moving thing that liveth," yet it is not probable, that fishes were used as food, to any considerable extent, for several centuries afterwards. It is stated by Plutarch, that the Syrians and Greeks, in very ancient times, abstained from fish. Menelaus, one of Homer's heroes, complains, on a certain occasion, that his companions had been reduced by hunger to the necessity of eating fish; and there is no mention in Homer, that the Grecians, at any time, used this food at the siege of Troy, although, for the ten years during which that contest was carried on, their camp was on the sea-shore.

2. Moses, the Jewish lawgiver, is very explicit in designating the land animals which might be used by the Israelites as food; but he imposes no restrictions, with regard to the animals which inhabit the waters. We learn, however, from the twelfth chapter of Numbers, that the children of Israel, while journeying to the land of Canaan, "remembered the fish which they did eat," in Egypt.

3. This is the earliest notice on record, of the actual use of that class of animals for food; although it is probable, that they had been applied to this purpose, in Egypt, six or seven hundred years before that period, or soon after the settlement of this country by the descendants of Ham.

4. For a long time before the advent of Our Saviour, fishing had been a regul business, even in Judea; and from t class of men who followed this occupatio

he chose several of his apostles. At the time just mentioned, fish had become a common article of diet, in all parts of the world subject to the Roman power, and probably in almost all other countries.

5. The methods of catching fish, pursued in ancient times, were similar to those of the present day, for then, as now, they were caught with a hook, with a spear, and with a seine or net, according to the character of the animal, and the nature of the fishing station. But the great improvements in navigation, made since the twelfth century, have given modern fishermen the command of the Atlantic and Pacific Oceans, and, consequently, a knowledge of many species of fish which were formerly unknown.

6. According to Linnæus, the great naturalist, about four hundred species of fish have come to our knowledge; and he estimates that those which remain unknown are probably still more numerous. Notwithstanding this great variety, the chief attention of fishermen is confined to a few kinds, which are the most easily caught, and which are the most valuable when taken.

7. Every place which contains many inhabitants, and which is located in the vicinity of waters well stored with fish, is supplied with these animals by men who make fishing a business: still, these fisheries may be considered local in their benefits, and perhaps do not require particular notice in this article. We will only remark, therefore, that, in large cities, fresh fish are sold either in a fish-market, or are *hawked* about the streets. The wives of the fishermen are very often employed in selling the fish caught by their husbands. The fisheries which are of the greatest consequence, in general commerce, are those which relate to herring, mackerel, salmon, seal, and whale.

8. *Herring Fishery.*—There are several species of herring; but, of these, four kinds only are of much importance, viz. the common herring, the shad, the hard head, and the alewife; of which, the first is the most valuable, being by far the most numerous, and being, also, better adapted than the others for preservation.

9. The winter residence of the common herring is within the arctic circle, whence it emigrates, in the spring, to more southern portions of the globe, for the purpose of depositing its spawn. The first body of these migratory animals, appears on the coasts both of Europe and America, in April, or about the first of May; but these are only the precursors of the grand shoals, which arrive in a few weeks afterwards.

10. Their first approach is indicated by the great number of birds of prey, which follow them in their course: but when the main body appears, the number is so great that they alter the appearance of the ocean itself. In this last and principal migration, the shoals are five or six miles in length, and three or four in breadth, and before each of these columns the water is driven in a kind of ripple: sometimes, the fish sink together ten or fifteen minutes, and then rise again to the surface, when they reflect, in clear weather, the rays of the sun, in a variety of splendid colours.

11. These fish proceed as far south as France, on the coasts of Europe, and as far as Georgia, in America, supplying every bay, creek, and river, which opens into the Atlantic. Having deposited their spawn, generally in the inland waters, they return to their head-quarters in the arctic ocean, and recruit their emaciated bodies for another migration in the following spring.

12. In a few weeks, the young ones are hatched by the genial heat of the sun; and, as they are not found in southern waters in the winter, it is evident that they proceed northward in the fall, to their paternal haunts under the ice, and thus repair the vast destruction of their race, which had been caused by men, fowl, and fish, in the previous season.

13. These fish are caught in nearly every river, from Maine to Georgia, which has a free communication with the Atlantic; but the most extensive fisheries are on the Hudson and Delaware rivers, and on those which flow into the Chesapeake bay.

14. The instrument employed in catching these fish is called a seine, which is a species of net, sometimes in length several hundred fathoms, and of a width suiting the depth of the water in which it is to be used. Both edges of the net-work are fastened each to a rope; and, to cause the seine to spread laterally in the water, pieces of lead are fastened to one side, and pieces of cork to the other.

15. In spreading the seine in the water, one end is retained on land by a number of persons, while the rest of it is strung along from a boat, which is rowed in the direction from the shore. The seine having been thus extended, the further end is brought round, in a sweeping manner, to the shore; and the fish that may be included are taken into the boats with a scoop-net, or are hauled out upon the shore. In this way, two or three hundred thousands are sometimes taken at a single *haul.* This fish dies immediately after having been taken from the water: hence the common expression, "As dead as a herring."

16. The herrings are sold, as soon as caught, to people who come to the fishing stations to procure them; or, in case an immediate sale cannot be effected, they are cured with salt, and afterwards smoked, or continued in brine. In the Southern States, the herring is generally thought to be superior to any other fish, for the purpose of salting down; although the shad, and some others, are preferred while fresh.

17. The importance of this fishery is superior to that of any other; since the benefits resulting from it are more generally diffused. The ancients, however, do not appear to have had any knowledge of this valuable fish. It was first brought into notice by the Dutch, who are said to have commenced the herring fishery on the coasts of Scotland, in the year 1164, and to have retained almost exclusive possession of it, until the beginning of the present century.

18. The shad is a species of herring, which inhabits the sea near the mouths of rivers, ascending them in the spring, to deposit its spawn. It is caught in all the rivers terminating on our Atlantic coasts, as well as in some of the rivers of the North of Europe. This fish is captured in the same manner, and often at the same time, with the common herring. It is highly esteemed in a fresh state; although it is not so good when salted, as the herring and some other kinds of fish.

19. *Mackerel Fishery.*—The common mackerel is a migratory fish, like the herring, and ranks next to that tribe of fishes in regard to numbers, and perhaps in general utility. Its place of retirement in the winter, is not positively known; but it is supposed by some, to be far north of the arctic circle; and by others, to be in some part of the Atlantic farther south. Shoals of this fish appear on the coasts both of Europe and America, in the summer season. Of this fish there are twenty-species.

20. The mode of catching the mackerel, is either with a net or with hooks and lines. The latter method succeeds best, when the boat or vessel is driven forward by a gentle breeze; and, in this case, a bit of red cloth, or a painted feather, is usually employed as a bait. Several hooks are fastened to a single line, and the fish bite so readily, that the fishermen occasionally take one on each hook at a haul. The mackerel are *cured* in the usual manner, and packed in barrels, to be sold to dealers.

21. This fish was well known to the ancients, as one of its places of resort, in the summer, was the Mediterranean sea. It was highly esteemed by the Romans, for the reason, that it was the best fish for making their *sarum*, a kind of pickle or sauce much esteemed by this luxurious people.

22. *Salmon Fishery.*—The salmon is a celebrated fish, belonging to the trout genus. It inhabits the seas on the European coasts, from Spitzbergen to Western France; and, on the western shore of the Atlantic, it is found from Greenland to the Hudson river. It also abounds on both coasts of the North Pacific Ocean. The length of full-grown salmon, is from four to six feet; and their weight, from ten to fifteen pounds.

23. As soon as the ice has left the rivers, the salmon begin to ascend them, for the purpose of depositing their spawn. It has been ascertained, that these fish retain a remarkable attachment to the river which gave them birth; and, having once deposited their spawn, they ever afterwards choose the same spot for their annual deposits. This latter fact has been established by a curious Frenchman, who, fastening a ring to the posterior fin of several salmon, and then setting them at liberty, found that some of them made their appearance at the same place three successive seasons, bearing with them this distinguishing mark.

24. In ascending the rivers, these fish usually proceed together in great numbers, mostly swimming in the middle of the stream; and, being very timid, a sudden noise, or even a floating piece of timber, will sometimes turn them from their course, and send them back to the sea; but having advanced a while, they assume a determined resolution, overcoming rapids and leaping over falls twelve or fifteen feet in perpendicular height.

25. Salmon are caught chiefly with seines, and sometimes seven or eight hundred are captured at a single haul; but, from fifty to one hundred is the most usual number, even in a favourable season. They are also taken in weirs, which are inclosures so constructed that they admit the ingress, but not the regress, of the fish.

26. The salmon fisheries are numerous in Great Britain and Ireland, as well as in most of the northern countries of Europe. In the United States, the most valuable fisheries of this kind are on the rivers in Maine, whence the towns and cities farther south are principally supplied with these fish, in a fresh condition. They are preserved in ice, while on their way to market. In the cured state, the salmon is highly esteemed, although it is not easily digested.

27. *Cod Fishery.*—There are several species of cod-fish, or gadus; but the most important and interesting of the class, is the common cod. These fish are found in great abundance on the south and west coasts of Iceland, on the coasts of Norway, off the Orkney and Western Isles, and in the Baltic sea. Farther south, they gradually diminish in numbers; and entirely

disappear, some distance from the Straits of Gibraltar.

28. But the great rendezvous of cod-fish is on the coasts of Labrador, the banks of Newfoundland, Cape Breton, and Nova Scotia. They are invited to these situations by the abundance of small fish, worms, and other marine animals of the crustaceous and testaceous kinds, on which they feed. The fishermen resort, in the greatest numbers, to the banks, which stretch along the eastern coasts of Newfoundland about four hundred and fifty miles. The water on these banks varies from twenty to fifty fathoms in depth.

29. By negociations with Great Britain, the French, Dutch, Spanish, and Americans, have acquired the right to catch and cure fish, both on the *Grand Banks* and several other places on the coasts of the English possessions in North America. The number of vessels employed on the several fishing stations, during each successive season, amounts to six or seven thousand, each measuring from forty to one hundred and twenty tons, and carrying eight or ten men.

30. The fishing on the Grand Banks commences in April, and continues until about the first of August. Here, the fish are caught exclusively with hooks, which are usually baited with a small fish called the capelin, as well as with herring, clams, and the gills of the cod itself: but this fish is not very particular in its choice of bait, biting greedily at almost any kind which may be presented. An expert fisherman will frequently catch from one to three hundred cod in a single day.

31. As soon as the fish have been caught, their heads are cut off, and their entrails taken out: they are then salted away in bulk, in the hold; and, after having lain three or four days to drain, they are taken to another part of the vessel, and again salted in the same manner. The fishermen from New-England, however, give them but one salting while on the fishing station; but, as soon as a cargo has been obtained, it is carried home, where conveniences have been prepared for curing the fish, to greater advantage. By pursuing this plan, two or three trips are made during the season. Some of the fish are injured before they are taken from the vessel; and these form an inferior quality, called *Jamaica fish*, because such are generally sold in that island, for the use of the slaves.

32. The fish which are caught on the coasts of Labrador, at the entrance of Hudson's Bay, in the Straits of Belleisle, and on fishing stations of similar advantages, are cured on the shore. They are first slightly salted, and then dried in the sun, either on the rocks, or on scaffolds erected for the purpose. In these coast fisheries, the operations commence in June, and continue until some time in August. The cod are caught in large seines, as well as with hook and line.

33. *Seal Fishery.*—There are several species of the seal; but the kind which is most numerous, and most important in a commercial view, is the common seal. It is found on the sea-coasts throughout the world, but in the greatest numbers in very cold climates, where it furnishes the rude inhabitants with nearly all their necessaries and luxuries.

34. The animal is valuable to the civilized world, on account of its skin and oil. The oil is pure, and is adapted to all the purposes to which that from the whale is applied. In the spring of the year, the seals are very fat; and, at that time, even small ones will yield four or five gallo oil. The leather manufactured from

skins, is employed in trunk-making, saddlery, and in making boots and shoes.

35. Since the whale fishery has declined in productiveness in the northern seas, *sealing* has arisen in importance; and accordingly, vessels are now frequently fitted out for this purpose, both in Europe and America; whereas, a few years since, it was regarded only as a part of the objects of a whaling voyage.

36. Our countrymen of New-England have particularly distinguished themselves in this branch of business; and the part of the globe which they have found to be the most favourable to their objects, has been the islands in the Antarctic ocean. A sealing voyage to that quarter often occupies three years, during which time the hunters are exposed to great hardships, being often left in small detachments on desolate islands, for the purpose of pursuing the animals to greater advantage.

37. The best time for sealing in the Arctic ocean, is in March and April, when the seals are often met with in droves of several thousands on the ice, which is either fixed, or floating in large pieces. When the sealers meet with one of these droves, they attack the animals with clubs, and stun them by a single blow on the nose. After all that can be reached, have been disabled in this way, the skin and blubber are taken off together.

38. This operation is called *flenching*, and is sometimes a horrible business; since some of the seals, being merely stunned, occasionally recover, and, in their denuded state, often make battle, and even leap into the water, and swim off. The skins, with the blubber attached to them, are packed away in the hold; and, in case the vessel is to return home soon, they are suffered to remain there, until she arrive in port: but, when this is not expected, the skins, as soon as convenient, are separated from the blubber, and the latter is put into casks. There are other methods of capturing the seal; but it is, perhaps, not necessary to enter into further details.

39. *Whale Fishery.*—There are five species of the whale, of which the ***Balæna Physalis***, or razor-back, is the largest. When full grown, it is supposed to be about one hundred feet in length, and thirty or thirty-five feet in circumference. It is so powerful an animal, that it is extremely difficult to capture it; and, when captured, it yields but little oil and whalebone. The species to which whalers direct their attention, is denominated the ***Mystecetus***, or the *right whale*.

40. The mystecetus is found, in the greatest numbers, in the Greenland seas, about the island of Spitzbergen, in Davis' Straits, in Hudson's and Baffin's Bays, and in the northern parts of the Pacific Ocean. It is also found in the Antarctic Ocean, and along the coasts of Africa and South America, and occasionally on the coasts of the United States.

41. Each vessel engaged in this fishery, is generally fitted out by several individuals, who receive, of the return cargo of oil and whale-bone, in proportion to the amount which they have contributed to the common stock, after the men have received their proportion of it. Should the voyage prove altogether unsuccessful, which seldom happens, the owners lose the amount of the outfit, and the captain and hands their time.

42. The whalers commence operations in the northern latitudes, in the month of May; but the whales are most plentiful in June, when they are met with between the latitudes 75° and 80°, in almost every variety of situation; sometimes in the open seas, at others in the loose ice, or at the

edges of the *fields* and *floes*, which are near the main, impervious body of ice.

43. On the fishing station, the boats are kept always ready for instant service, being suspended from davits or cranes by the sides of the ship, and being furnished with a lance and a harpoon, to the latter of which is attached about one hundred and twenty fathoms of strong but flexible rope. When the weather and situation are favourable, the *crow's-nest*, which is a station at the mast-head, is occupied by some person with a telescope.

44. The moment a whale is discovered, notice is given to the watch below, who instantly man one or two boats, and row with swiftness to the place. Sometimes, a boat is kept manned and afloat near the ship, that no time may be lost in making ready; or, two or three are sent out on *the look-out*, having every thing ready for the attack.

45. The whale being very timid and cautious, the men endeavour to approach him unperceived, and strike him with the harpoon, before he is aware of their presence. Sometimes, however, he perceives their approach, and dives into the water, to avoid them; but, being compelled to come again to the surface to breathe, or, as it is termed, *to blow*, they make another effort to harpoon him. In this way, the whalers often pursue him for a considerable time, and frequently without final success. The animal, when unmolested, remains about two minutes on the surface, during which time he blows eight or nine times, and then descends for five or ten minutes, and often, while feeding, for fifteen or twenty.

46. When the whale has been struck, he generally dives towards the bottom of the sea, either perpendicularly or obliquely, where he remains about thirty minutes, and sometimes nearly an hour. The harpoon has, near its point, two barbs or withers, which cause it to remain fast in the integuments under the skin; and the rope attached to it, is coiled in the bow of the boat, in such a way that it runs out without interruption. When more line is wanted, it is made known to the other boats by the elevation of an oar. Should the rope prove too short for the great descent of the whale, it becomes necessary to sever it from the boat, lest the latter be drawn under water: for this emergency, the harpooner stands ready with a knife.

47. When the whale reappears, the assisting boats make for the place with their greatest speed, and, if possible, each harpooner plunges his weapon into the back of the creature. On convenient occasions, he is also plied with lances, which are thrust into his vitals. At length, overcome with wounds, and exhausted by the loss of blood, his approaching dissolution is indicated by a discharge of blood from his blow-holes, and sometimes by a convulsive struggle, in which his tail, raised, whirled, and jerked in the air, resounds to the distance of several miles. The whale having been thus conquered, and deprived of life, the captors express their joy with loud huzzas, and communicate the information to the ship by striking their flag.

48. A position near a large field of solid ice is very advantageous, because a whale diving under it is obliged to return again, to blow; and this circumstance gives opportunity to make upon him several attacks. Close fields of drift ice present great difficulties, since the boats cannot always pass through them, with sufficient celerity: in that case, the men sometimes travel over the ice, leaping from one piece to another, and carrying with them lances and harpoons, with which they pierce the anima

as often as possible. If they succeed in thus killing him, they drag him back under the ice, with the fast line.

49. The whale, having been towed to the ship, and secured alongside, is raised a little by means of powerful blocks, or tackle. The harpooners, with spurs fastened to the bottom of their feet, to prevent them from slipping, descend upon the huge body, and, with spades and knives adapted to this particular purpose, cut the blubber into oblong pieces, which are peeled off, and hoisted upon deck with the *speck-tackle.* These long strips are then cut into chunks, which are immediately packed away in the hold. After the animal has been thus successfully flenched, and the whale-bone taken out, the carcase is dismissed to the sharks, bears, and birds of prey.

50. The blubber is somewhat similar, in consistence, to the fat which surrounds the body of the hog, although not quite so solid. In young whales, its colour is yellowish white; and, in old ones, yellow or red. Its thickness varies in different parts, and in different individuals, from eight to twenty inches. The weight of a whale sixty feet in length, is about seventy tons, of which the blubber weighs about thirty tons.

51. The whale-bone is situated in the mouth. About three hundred laminæ, or blades, grow parallel to each other on either side of the upper jaw, being about half an inch thick, and ten or twelve inches wide, where they are united by the gum. As the whale grows old, they increase in length, and approach from each side to the roof of the mouth. The whale, while feeding, swims with his mouth wide open, which admits a great quantity of water containing insects, or small fish, on which he subsists. The whale-bone acts as a filter, or strainer, in retaining the little animals, while the water passes off at the corners of the mouth.

52. Before the whalers leave the fishing station, they cut the blubber into small pieces, and put it into close casks. Sometimes, however, when the ship has been very successful, there is a deficiency of casks: in that case, it is slightly salted, and packed away in the hold. But as the ship must necessarily pass through a warmer climate, on her voyage homeward, the blubber, while packed in this manner, is liable to melt and be wasted, unless the weather should prove uncommonly cool.

53. When the vessel has arrived in port, the blubber is found to be melted. To separate the oil from the *fritters*, or *fenks*, as the integuments and other impurities are called, the contents of the casks are poured into copper boilers, and heated: the heat causes a part of the latter to sink to the bottom, and the former is drawn off into coolers, where other extraneous matters settle. The pure or fine oil is then drawn off, for sale. An inferior quality of oil, called *brown oil*, is obtained from the dregs of the blubber.

54. The spermaceti cachalot, or ***Physeter Macrocephalus***, is an animal belonging to the norwal genus, although it is generally denominated the spermaceti whale. It is found in the greatest abundance in the Pacific Ocean, where it is sought by American, and other whalers, for the sake of the oil and spermaceti. This animal is gregarious, and is often met with in herds containing more than two hundred individuals.

55. Whenever a number of the cachalot are seen, several boats, manned each with six men, provided with harpoons and lances, proceed in pursuit; and, if possible, each boat strikes or fastens to a distinct

animal, which, in most cases, is overcome without much difficulty. Being towed to the ship, it is deprived of its blubber, and the matter contained in the head, which consists of spermaceti combined with a small proportion of oil. The oil is reduced from the blubber, soon after it has been taken on board, in "try works," with which every ship engaged in this fishery is provided.

56. About three tons of oil are commonly obtained from a large cachalot of this species, and from one to two tons from a small one, besides the head-matter. The manner in which these two products are treated, when brought into port, has been described in the article on candle-making.

57. The Biscayans were the first people who prosecuted the whale fishery, as a commercial pursuit. In the twelfth, thirteenth, and fourteenth centuries, they carried on this business to a considerable extent; but the whales taken by them were not so large as those which have since been captured in the polar seas. At length, the whales ceased to visit the Bay of Biscay, and the fishery in that quarter was of course terminated.

58. The voyages of the English and Dutch to the Northern Ocean, in search of a passage to India, led to the discovery of the principal haunts of the whale, and induced individuals in those nations to fit out vessels to pursue these animals in the Northern latitudes, the harpooners and part of the crews being Biscayans. The whales were found in the greatest abundance, about the island of Spitzbergen, and were, at first, so easily captured, that extra vessels were sent out in ballast, to assist in bringing home the oil and whalebone; but the whales, retiring to the centre of the ocean, and to the other side, to the Greenland seas, soon became scarce about that island.

59. The whale fishery was revived, as above stated, about the beginning of the seventeenth century; and, with the Dutch, it was in the most flourishing condition in 1680, when it employed about two hundred and sixty ships, and fourteen thousand men. The wars at the end of the eighteenth, and the beginning of the nineteenth centuries, extending their baleful influence to almost every part of the ocean, annihilated this branch of business, among the Dutch; and, in 1808, only a single whale-ship sailed from Holland.

60. The English whale fishery was, at first, carried on by companies enjoying exclusive privileges; but the pursuit was attended with little success. In 1732, Parliament decreed a bounty of twenty shillings per ton, on every whaler measuring more than two hundred tons; and, although this bounty was increased in 1749 to forty shillings, yet the English whale fishery has never been very flourishing.

61. The whale fishery has been carried on with greater success from the United States, than from any other country. It was begun by the colonists, on their own shores, at a very early period; but the whales having abandoned the coasts of North America, these hardy navigators pursued them into the northern and southern oceans.

62. The number of American vessels now employed in pursuit of the spermaceti cachalot, and the mystecetus, amounts to about four hundred, employing ten thousand men. The inhabitants of the island of Nantucket, and of the town of New-Bedford, are more extensively engaged in these fisheries than the people of any other parts of the United States.

THE SHIPWRIGHT.

1. The earliest notice we have of the construction of a building to float on water, is that which relates to Noah's Ark. This was the largest vessel that has ever been built, and the circumstance proves that the arts, at that early period, had been brought to considerable perfection: yet, as several centuries had elapsed, after the flood, before the descendants of Noah had much occasion for floating vessels, the art of constructing them seems to have been measurably lost.

2. Early records, which perhaps are worthy of credit, state that the Egyptians first traversed the river Nile upon rafts, then in the canoe; and that, to these succeeded the boat, built with joist, fastened together with wooden pins, and rendered water-tight by interposing the leaves of the papyrus. To this boat was, at length, added a mast of acanthus, and a sail of papyrus; but, being prejudiced against the sea, because it swallowed up their sacred river, which they were accustomed to worship as a god, they never attempted to construct vessels adapted to marine navigation.

3. The Phœnicians, a nation nearly as ancient as the Egyptian, being situated directly on the sea, without the advantages of a noble river, were compelled to provide means for sailing on a wider expanse of water. It is said, however, that they first traversed the Mediterranean, and even visited distant islands, with no better means of conveyance than a raft of timber. This is rendered somewhat probable, from the fact, that the Peruvians, even at the present time, venture upon the Pacific Ocean

on their *balza*, a raft made from a spongy tree of that name.

4. The vessels first constructed by the Phœnicians, were used for commercial purposes: they were flat-bottomed, broad, and of a small draught; and the Carthaginians and Greeks likewise adopted this general shape. The ships of war, in early times, were generally mere row-boats, in which the combatants rushed upon each other, and decided the combat by valour and physical strength.

5. By successive improvements, the ships of antiquity were, at length, brought to combine good proportion with considerable beauty. The prows were sometimes ornamented with the sculptured figures of the heathen deities, and otherwise adorned with paint and gilding; while the sterns, which were usually in the form of a shield, were elaborately wrought in carved work. The approved length of a ship of war, was six or eight times its breadth; and that for mercantile purposes, four times the breadth: hence, the distinction of *long ships*, and *round ships*.

6. Both the long and round ships had a single mast, which could be taken down or elevated at pleasure. These vessels were, however, propelled with oars on occasions that required it; and the former, in their improved state, were properly galleys with one, two, or three banks of oars, which extended from one end of the vessel to the other. The rowers were all placed under the deck; and, in time of battle, the combatants contended above, being in part defended from the missiles of opposing foes by shields, and additionally by screens and towers covered with raw hides. The bow of each vessel was armed with a brazen or iron beak, with which the contending parties often stove in the sides of each other's vessels.

7. The general size of vessels in the best days of antiquity, was not greater than that of our sloops and schooners; but there are instances on record, which prove that they occasionally equalled in capacity the largest of modern times. In the early ages, they were very small, and, for several centuries, were drawn upon the shore at the termination of every voyage. Stranding, however, became impracticable, after the increase in size, and the addition of the keel. The anchor and cable were therefore invented, to confine the ship at a suitable distance from the shore. At first, the anchor was nothing more than a large stone: afterwards, it was wood and stone combined; and finally, iron was the sole material.

8. The invasion of the Roman empire by the northern barbarians, caused the operations of war to be almost exclusively conducted on the land: this, together with the destruction of commerce during the general desolation of those ruthless incursions, and the barbarism of the conquerors, occasioned a retrogression, and, in some parts of Europe, nearly the total destruction of the art of building ships.

9. The active trade which arose in the Mediterranean, during the middle ages, and the naval enterprises connected with the Crusades, occasioned a revival of the art of constructing ships; yet, it did not advance beyond the condition in which the Carthaginians had left it, until about the middle of the fourteenth century. At this era, the inconsiderable galleys of former times began to be superseded by larger vessels, in which, however, oars were not entirely disused.

10. The great change in the general construction of vessels, arose from the discovery of the polarity of the magnet, and the application of astronomy to nautical

pursuits; for, by these means, the mariner was released from his dependence on a sight of the land, in guiding his vessel on its course. Larger ships were therefore constructed, capable of withstanding the power of more violent storms and loftier waves.

11. To the Italians, Catalans, and Portuguese, was ship-building most considerably indebted, in the early days of its revival. The Spaniards followed up their discovery of the New World with a rapid improvement both in the form and size of their ships; some of which even rated at two thousand tons burden. In more modern times, it is said, that the Spaniards and French are entitled to the credit of nearly all the improvements which have been made in the theory of the art; the English having never contributed essentially to advance it, although the greatest naval power of this or any other time.

12. In the United States, very great improvements have been made in the construction of vessels, since the commencement of the present century. Our builders, however, are less guided by scientific rules than by experience and a practised eye; yet, it is generally conceded, that our ships of war and first-rate merchantmen, are superior, in swiftness and beauty, to those of any other country.

13. In Europe, the first thing done towards building a vessel, is to exhibit it in three distinct views, by as many separate drawings; but, in the United States, the builder commences by framing a complete wooden model of the proposed construction,—the thing itself in miniature. From this practice of our naval architects, have arisen the superior beauty and excellence of our vessels.

14. The timber generally used in the *construction* of American vessels, is live-oak, pine, chestnut, locust, and cedar. The trees of mature growth are chosen, and girdled in the beginning of winter, at which time they contain but little sap: when sufficiently dry and hardened, the trees are felled; and, after the timber has been roughly hewn, it is carefully stored in some dry, airy place, not much exposed to wind or sun.

15. In collecting ship-timber, the greatest difficulty is found in procuring the crooked sticks, which form the sides or ribs of the skeleton of a vessel. In countries where ship-timber has become an object of careful cultivation, this difficulty is anticipated by bending the young trees to the desired form, and confining them there, until they have permanently received the proper inclination. The timber is brought to market in its rough state, and sold by the foot.

16. The timber having been selected, the workmen proceed to fashion the various parts of the proposed vessel, with appropriate tools, being guided in their operations by patterns, which have been made after the exact form of the various parts of the model. Much care is taken to avoid cutting the wood contrary to the grain, that its strength may not be impaired.

17. After all the parts of the frame have been made ready, they are put together. The several blocks of timber on which the vessel is raised, are called the *stocks;* and to these pieces, the foundation, called the *keel*, is temporarily fastened, in an inclined position. The keel is inserted into the *stern-post* at one end, and into the *stem* at the other. The *floor-timbers* are next fixed in the keel, every other one being there firmly bolted and riveted. Each of these timbers is a branch and part of the body of a tree; and, when composing a part of a vessel, they bear the same rela-

tion to it as the ribs to the human body: with equal propriety, the keel has been compared to the vertebral column, or backbone.

18. The next step is to apply and fasten the planks, which serve not only to exclude the water, but to bind all the parts firmly and harmoniously together. Simple as this part of the operation may seem to be, it is the most difficult to be effected, and requires a preconcerted plan as much as any other part of the fabric. When it is necessary to bend a plank at the bow or stern, it is heated by steam, and then forced into place with screws and levers. The planks are fastened with iron or copper bolts.

19. The planking having been finished, and several particulars attended to, which cannot be well understood from description, the vessel is ready for the work of the *caulker*, who carefully stops all the seams with oakum, and smears them with pitch. After the *scraper* has cleared away the superfluous pitch, water is pumped into the hold, to ascertain if there be any leak.

20. The bottom of the vessel is next sheathed, either with sheets of copper or pine boards, to protect it from the worms: the latter materials are employed when the planks have been fastened with iron; since the copper would cause the bolt-heads to corrode, if placed against them. In either case, sheets of paper, soaked in hot pitch, are interposed between the planks and the sheathing.

21. The vessel is now ready to be removed from the stocks to the water. This removal is called launching, which, in many cases, requires much skill in the preparation, and successive management. If there is no permanent inclined plane in the slip, on which the vessel may glide into the water, a temporary one is prepared, consisting of two platforms of solid timber, erected one on each side of the keel, at a distance of a few feet from it, and extending from the stem into the water. Upon this double platform, which is called the *ways*, is erected another set of timbers, and the space between these and the vessel is filled all along with wedges. The whole of this superstructure is called the *cradle*, and the extremities of it are fastened to the keel, at the bow and stern, with chains and ropes.

22. Every thing having been thus prepared, the wedges are simultaneously driven on both sides: by this means, the vessel is raised from the stocks, and made to rest entirely on the cradle. After the *shores* have been all removed, the cradle, with its weighty burden, begins to move; and, in a moment, the vessel is launched upon its destined element.

23. Among the ancients, a launch was ever an occasion of great festivity. The mariners were crowned with wreaths, and the ship was bedecked with streamers and garlands. Safely afloat, she was purified with a lighted torch, an egg, and brimstone; and solemnly consecrated to the god whose image she bore. In our less poetic times, there is no lack of feasting and merriment, although the ceremony of consecration is different; the oldest sailor on board merely breaking a bottle of wine or rum over the figure-head,—still, perchance, the image of father Neptune, or Apollo.

24. The vessel, now brought to the wharf, is to be equipped. The mode of doing this, is varied according as it may be a ship, brig, hermaphrodite brig, schooner, or sloop. The masts are first erected, and these are supplied with the necessary apparatus of spars, rigging, and sails. The latter are furnished by the sail-maker, who is sometimes denominated the ***ship's tailor.***

THE MARINER.

1. The business of the mariner consists in navigating ships, and other vessels, from one port to another. This is an employment that requires much decisive resolution; and Horace has well said, that "his breast must have been bound with oak and triple brass, who first committed his frail bark to the tempestuous sea." There is certainly nothing which speaks louder in praise of human ingenuity, than that art by which man is able to forsake the land, contend successfully with winds and waves, and reach, with unerring certainty, his destined port in some distant part of the world.

2. Nor are the skill and intrepidity exhibited in this arduous employment, more worthy of our admiration, than the wonderful advantages resulting from it; for, we are indebted to the exercise of this art, for those improvements in our condition, which arise from the exchange of the superfluities of one country for those of another; and, above all, for the interchange of sentiments, which renders human knowledge coextensive with the world.

3. Ship-building is so intimately connected with the art of navigation, that the historical part of the former subject is equally applicable to the latter: it is, therefore, unnecessary to be particular on this point. We shall merely supply some omissions in the preceding article.

4. The sailors of antiquity confined their navigation chiefly to the rivers, lakes, and inland seas; seldom venturing out of sight of land, unless, from their knowledge of the coasts ahead, they were certain to

meet with it again in a short time. When they thus ventured from the land, or were driven from it by tempests, the stars and planets were their only guides.

5. The qualifications of a skilful pilot or master, even for the Mediterranean seas, in those days, required more study, and more practical information, than are necessary to render a mariner a complete general navigator, in the present improved state of the science of navigation; for then he must needs be acquainted, not only with the general management of the ship, but also with all the ports, land-marks, rocks, quicksands, and other dangers, which lay in the track of his course. Besides this, he was required to be familiar with the course of the winds, and the indications that preceded them; together with the movements of the heavenly bodies, and the influence which they were supposed to exert on the weather; nor was the ability to read the various omens which were gathered from the sighing of the wind in the trees, the murmurs of the waters and their dash upon the shore, the flight of birds, and the gambol of fishes, a qualification to be dispensed with.

6. A voyage, in ancient times, was a momentous undertaking, and was usually preceded by sacrifices to those gods who were supposed to preside over the winds and the waves. All omens were carefully regarded; and a very small matter, such as the perching of swallows on the ship, or an accidental sneeze to the left, was sufficient to delay departure. When, under proper auspices, a vessel or fleet had set sail, and had advanced some distance, it was customary to release a number of doves, which had been brought from home; the safe arrival of these birds, at the houses of the voyagers, was considered an auspicious omen of the return of the fleet.

7. Having escaped the multiplied dangers of the sea, the sailors, on their return, fulfilled the vows which they had made before their departure, or in seasons of peril; offering thanks to Neptune, and sacrifices to Jupiter, or some other of their gods, to whose protection they may have committed themselves. Those who had suffered shipwreck, felt themselves under greater obligations of gratitude; and, in addition to the usual sacrifices, they commonly offered the garment in which they had been saved, together with a pictorial representation of the disaster. If the individual escaped only with life, his clothing having been totally lost, his hair was shorn from the head, and consecrated to the tutelar deity.

8. There is much that is beautiful in these simple acts of piety; and similar customs, with regard to shipwrecked mariners, are still in existence in the Catholic countries of the Mediterranean; but the worship of the heathen deities having been discontinued, a favourite saint, or perchance the true God, is substituted for them. Although such acts of piety may not avail to avert impending danger, yet their natural tendency doubtless is to inspire courage to meet it, when it may arise.

9. The Carthaginians, for several centuries, were more extensively engaged in commerce, than any other people of antiquity; and, as they carried on their lucrative trade with other nations, and their own colonies, by means of ships, they exceeded all others in the art of navigation. Not content with exploring every nook and corner of the Mediterranean, they passed the Pillars of Hercules, as the promontories of the Straits of Gibraltar were then called, and visited the Atlantic coasts of Europe, as far north as the Scilly Islands, then denominated the Cassorides.

It is asserted by Pliny, that Hanno even circumnavigated Africa.

10. The destruction of Carthage by the Romans, in the year before Christ 146, interfered with improvements in the art of navigation: and the invasion of the northern barbarians, several centuries afterwards, extinguished nearly all the knowledge which had been previously acquired: nor was it again revived, and brought to the state in which it existed in the flourishing era of antiquity, until about the middle of the fourteenth century.

11. After the period just mentioned, improvements in this art followed each other in close succession. The chief cause of this rapid advance, was the discovery of the polarity of the magnet, and the consequent invention of the mariner's compass. The power of the loadstone to attract iron, was early known to the Greeks and Chinese; but its property of pointing in a particular direction, when suspended and left to move freely, was not suspected until about the year 1200 of our era.

12. At first, mariners were accustomed to place the magnetic needle on a floating straw, whenever they needed its guidance; but, in 1302, one Flavio Giaio, an obscure individual of the kingdom of Naples, placed it on a permanent pivot, and added a circular card: still, it was nearly half a century after this, before navigators properly appreciated, and implicitly relied on, this new guide. The compass did not reach its present improved state, until the middle of the sixteenth century.

13. As soon as the reputation of this instrument had become well established, navigation assumed a bolder character; and the capacity of vessels having been enlarged to meet this adventurous spirit, oars were laid aside as inapplicable, and sails alone were relied upon, as means of propulsion.

14. Navigation, in the early days of its revival, was indebted to the Portuguese for many valuable improvements. To them, also, is the world under obligation for many splendid discoveries; among which was that of a passage by sea to India. This long-desired discovery was made in 1497, by Vasco de Gama, who had been sent out for the purpose by Emanuel, king of Portugal.

15. Five years before Vasco de Gama had found his way to India, by the way of the Cape of Good Hope, Columbus made his discovery of the New World. This great man had conceived or adopted the idea, that the form of our earth was spherical;—contrary to the generally received opinion, that it was an extended plane;—and learning that India stretched to an unknown distance eastward, he supposed that, by sailing in an opposite direction, the navigator would meet with its eastern extremity.

16. Pursuing this idea, he applied successively to the governments of several states and kingdoms, for patronage to enable him to test its correctness; and having, at length, succeeded in obtaining three small vessels, with the necessary equipments, from Ferdinand and Isabella, sovereigns of Arragon and Castile, he proceeded on his proposed voyage, which resulted in the discovery of the American continent.

17. These two great discoveries gave another powerful impulse to navigation; and inventions and improvements multiplied in rapid succession. The learned and ingenious, who at different times have turned their attention to the subject of navigation, have supplied the mariner with various means, by which he can direct his

course on the deep with accuracy and certainty.

18. The instruments now employed in navigation, are the mariner's compass, the azimuth compass, the quadrant, the sextant, the chronometer, the half minute-glass, the log, and the sounding-line. In addition to these, the general navigator needs accurate maps and charts, lists of the latitude and longitude of every part of the world, the time of high water at every port, and a book of navigation, containing tables, to aid him in performing various calculations with facility; and, with a view to calculate the longitude by observation, he should be furnished with the Nautical Almanac, containing the places and declinations of the fixed stars and planets, and especially the distances of the moon from the sun and other heavenly bodies.

19. The mariner's compass, as has been before observed, is employed to indicate the various points of the horizon; but the magnetic needle varying more or less from the exact northern and southern direction, the azimuth compass is used, to show the degree of that variation. The quadrant and sextant are employed to ascertain the altitude and relative position of the heavenly bodies, that the mariner may determine the latitude and longitude in which his vessel may be. The chronometer is nothing more than a watch, designed to measure time with great accuracy. This instrument is used to determine the longitude.

20. The log is used for ascertaining the velocity of the ship on the water. It consists of a quadrangular piece of wood, eight or nine inches long, to which is attached a small cord, having knots in it, at proper distances from each other. In the application, the log is thrown upon the water, where it will not be disturbed by the wake of the ship; and the cord, being wound upon a reel, passes from it as fast as the vessel moves in the water. The number of knots, which pass off every half minute, indicates the number of miles which the ship sails per hour: hence, in nautical language, *knots* and *miles* are synonymous terms. The sounding-line is a small cord, with several pounds of lead of a conical figure attached to it; and is employed in trying the depth of the water, and the quality of the bottom.

21. Navigation is either *common* or *proper*. The former is usually called coasting, as the vessel is either on the same or neighbouring coast, and is seldom far from land, or out of sounding. The latter is applied to long voyages upon the main ocean, when considerable skill in mathematics and astronomy, together with an aptness in the use of instruments for celestial observations, are required in the captain or master.

22. The application of steam to the purposes of navigation, is one of the greatest advantages that science has bestowed upon this art. In point of economy, however, steam-boats have not yet been able to compete extensively with vessels propelled by sails, except in the conveyance of passengers; and even in this case, their application has hitherto been chiefly confined to rivers, lakes, bays, and arms of the sea; although the practicability of navigating the ocean by steam, has been proved by actual experiment.

23. The chief obstacle to the employment of steam, in long voyages, arises from the difficulty of generating a sufficient quantity of this agent, with the fuel which could be carried without overburthening the vessel; but a remedy for this

inconvenience will probably be found, in improvements in the construction of steam-generators.

24. The power of confined steam acting by its expansive force, was discovered by the celebrated Marquis of Worcester, about the middle of the seventeenth century; but the first working steam-engine was constructed in 1705, by Thomas Newcomer, a blacksmith of Dartmouth, Devonshire, England. About the year 1769, James Watt, a native of Glasgow, added a great number of improvements, of his own invention.

25. Steam navigation was first suggested in England, in 1736, by Jonathan Hulls. It was first tried in practice in France, in 1782, by the Marquis de Jouffroy, and nearly at the same time by James Rumsey, of Virginia, and John Fitch, of Philadelphia; but it was first rendered completely successful at New-York, in 1807, by Robert Fulton.

26. The sailors employed by the captain, to aid him in navigating his ship, are called *a crew*; and the individuals composing it are responsible to the captain, the captain to the owners, and the owners to the merchants, for all damages arising from negligence, or bad management.

27. In England, ample provisions are made at Greenwich Hospital, or by pensions, for seamen disabled by age or otherwise. These benefits, however, are extended only to those who have been engaged in the national service. This noble and politic institution is supported partly by public bounty, and in part by private donations, and a tax of sixpence per month, deducted from the wages of all the seamen of the nation. Marine Hospitals, for the temporary accommodation of seamen, suffering from disease, have been established in several cities of the continent of Europe, as well as of the United States.

28. Mariners have ever been a distinct class of men, and in their general characters very similar in every age of the world. Their superstitious regard of the many signs of good and bad luck, is nearly the same now that it was two or three thousand years ago. In ancient times, they had their lucky and unlucky days; and now, very few sailors are willing to leave port on Friday, lest the circumstance bring upon them some disaster, before the conclusion of the proposed voyage.

29. Superstitions of this nature, however, are not confined to the navigators of the deep. Even in this country, where the inhabitants enjoy superior intellectual advantages, and boast a high degree of intelligence, thousands of persons who have never been on board of a ship, are still under the influence of such heathen notions, notwithstanding their pretended belief in Christianity, which, in all cases, when properly understood, would prevent the forebodings of evil, or expectations of good, from unimportant prognostics.

THE MERCHANT.

1. The word *merchant*, in its most extended application, signifies, a person who deals in merchandise. This definition, with some exceptions, agrees very well with general usage in this country; although, in England, the term is principally restricted to those dealers who export and import goods on their own account, either in their own or in chartered vessels. In the United States, dealers of this class are denominated *importing* and *exporting* merchants; or simply, *importers* and *exporters*.

2. Such merchants, both here and in Europe, are distinguished from each other by the kind of goods in which they traffic, or by the foreign country in which they have their chief correspondence: thus, one who deals in tobacco is called a tobacco-merchant; a wholesale dealer in wines, is called a wine-merchant; a West India, East India, or Turkey merchant, exports goods to, and imports goods from, those respective countries.

3. The business of merchants, in foreign countries, is usually transacted by agents, called factors, or commission-merchants, to whom goods are consigned to be sold, and by whom other articles of merchandise are purchased, and returned according to order. Sometimes an agent, called a supercargo, accompanies the vessel; or the captain may act in this capacity. Goods, however, are often obtained by order, without the intervention of an agency of any kind.

4. Almost every sort of merchandise brought from a foreign country, is subject

to the imposition of duties by the government of the country in which it is received. These duties are paid at the *Custom-House*, to persons appointed by the constituted authorities to collect them. As soon as a vessel has entered the harbour from abroad, it is visited by a custom-house officer, called a *Tide-Waiter*, whose business it is to see that no part of the cargo be removed, until measures have been taken to secure the customs.

5. Goods brought into the country by importers, are frequently sold, in succession, to several merchants of different grades, before they come to the hands of the consumers. Cloths or stuffs, of different kinds, for instance, may be first sold by the bale to one merchant, who, in turn, may dispose of them by the package to another, and this last may retail them in small quantities to a greater number of customers.

6. Dealers in a small way, in cities and large towns, are frequently denominated *shop-keepers*; but those who do an extensive retail business, are usually called merchants or grocers, according as they deal in dry goods or groceries. In cities, the extensive demand for goods enables retailers to confine their attention to particular classes of articles; such as groceries, hardware, crockery, a few kinds of dry goods, or some articles of domestic manufacture: but in other places, where trade is more limited, the merchant is obliged to keep a more general assortment.

7. The general retail merchant is compelled to transact business with a great number of wholesale dealers, to whom he pays cash in hand, or agrees to pay it at some fu [illegible] ay, in four, six, nine, or tw [illegible] he people in his vic [illegible] his goods on [illegible] this difference, that they often substitute for cash agricultural and other productions, which the merchant, at length, turns into ready money.

8. Barter, or the exchange of commodities, prevails to a great extent, in country places, in almost every part of the United States. In such exchanges, the currency of the country is made the standard of reference: for example, a merchant receiving from a customer twenty bushels of wheat, estimated at one dollar per bushel, gives in return twenty dollars' worth of goods, at his marked prices; or, in other words, he gives credit for the wheat, and charges the goods. On the same principle, merchants of the first class often exchange the productions of their own country for those of another.

9. Merchants, or store-keepers, as they are indifferently called in some places, whose location is distant from the seaboard, visit the city in which they deal once or twice a year, for the purpose of laying in their stock of goods; but, in order to keep up their assortment, they sometimes order small lots in the interim. Retailers more conveniently situated, purchase a smaller amount of goods at a time, and replenish their stores more frequently.

10. Commerce, on the principles of barter, or a simple exchange of one commodity for another, must have been practised in the early days of Adam himself, although we have no positive record of the fact; for it cannot be imagined that the arts, which are stated in the scripture to have flourished long before the flood, could have existed without commercial transactions. The period at which the precious metals began to be employed as a standard of value, or as a medium of commercial intercourse, is not known. They were used for this purpose in the time of Abra-

ham, and probably many centuries before his day.

11. The earliest hint respecting the existence of trade between different nations, is to be found in the book of Genesis; where the transaction regarding the sale of Joseph to the Ishmaelites or Midianites, is mentioned. These merchants, it appears, were travelling in a caravan to Egypt, then the most cultivated and refined part of the world: their camels were loaded with balm, myrrh, and spices. The first of these articles was the production of Gilead; the second, of Arabia; and the last was probably from India, as in that country the finer spices are produced. If this were really the case, commerce, in its widest sense, was carried on much earlier than is generally supposed.

12. The fertility of Egypt, and its central position, made it an emporium of commerce; and there it flourished, in an eminent degree, long before it was cultivated in Europe and in Western Asia. For several ages, however, the Egyptians, on account of their superstitious prejudices against the sea, carried on no maritime commerce.

13. The Phœnicians were the first people who used the Mediterranean sea, as a highway for the transportation of merchandise. Tyre and Sidon were their chief cities; and the latter was called a *great*, and the former a *strong* city, even in the time of Joshua, fifteen hundred years before the advent of Christ. These people, in their original association as a nation, possessed but a small territory; and, being surrounded by many powerful nations, they never attempted its enlargement on the land side.

14. The settlement of the Israelites in the "Promised Land," circumscribed their limits to a very small territory, and compelled them to colonize a great number of their inhabitants. The colonies which they formed in the various countries bordering upon the Mediterranean, and on the islands, enlarged the boundaries of civilization, and greatly extended their trade.

15. The Phœnicians continued their colonial system for many centuries after the period just mentioned, and even extended it to the Atlantic coasts of Europe; but the most distinguished of all their colonies was the one which founded the city of Carthage, on the northern coast of Africa, about the year 869 before Christ. Elissa, or, as she is otherwise called, Dido, the reputed leader of this colony, makes a conspicuous figure in one of the books of Virgil's Æneid.

16. Carthage, adopting the same system which had so long been pursued by the great cities of Phœnicia, arose, in a few centuries, to wealth and splendour: but changing, at length, her mercantile for a military character, she ruled her dependent colonies with a rod of despotism. This produced a spirit of resistance on the part of her distant subjects, who applied to Rome for aid to resist her tyranny. The consequence of this application was, the three "Punic wars," so renowned in history, and which terminated in the destruction of Carthage, in the year 146 before the Christian era. During the first Punic war, Carthage contained seven hundred thousand inhabitants; at its destruction, scarcely five thousand were found within its walls.

17. The period of the greatest prosperity of Tyre, may be placed 588 years before Christ, at which time the remarkable prophecies of Ezekiel concerning it were delivered. Soon after this, it was

greatly injured by Nebuchadnezzar; and was finally destroyed by Alexander the Great, about the year 332 before Christ.

18. A new channel was opened to commerce by the monarch just mentioned, he having founded a city in Egypt, to which he gave the name of Alexandria. His object seems to have been, to render this city the centre of the commercial world; and its commanding position, at the mouth of the Nile, was well calculated to make it so, since it was easy of access from the west by the Mediterranean, from the east by the Red Sea, and from the central countries of Asia by the Isthmus of Suez.

19. The plans of Alexander were carried on with vigour by Ptolemy, who received Egypt as his portion of the Macedonian empire, after the death of his master; and, by his liberality, he induced great numbers of people to settle in the new metropolis, for the purposes of trade. Far south, on the Red Sea, he also founded a city, which he called Berenice, and which he designed as a depôt for the precious commodities brought into his kingdom from India. From this city, goods were transported on camels across the country, to a port on the Nile; and thence, they were taken down the river to Alexandria.

20. Ptolemy also kept large fleets, both on the Mediterranean and the Red Sea, for the protection of commerce, and the defence of his dominions; yet, the Egyptians, even under the Ptolemies, never attempted a direct trade to India. They, as the Phœnicians and their own progenitors had done for ages, depended upon the Arabian merchants for the productions of that country.

21. The Greeks, before their subjugation to the Roman power, had paid much attention to nautical affairs; but this had been chiefly for warlike dominion, rather than for commercial purposes. The city of Corinth, however, had become wealthy by the attention of its inhabitants to manufactures and trade; but it was destroyed by the same barbarian people who, about this time, annihilated Carthage. Both of these cities were afterwards favoured by Julius Cæsar; but they never regained anything like their former importance.

22. Rome having, at length, obtained the complete dominion of the Mediterranean Sea, and the countries bordering upon it, as well as of many others more distant, and less easy of access, became the great mart for the sale of merchandise of every description, from all parts of the known world. For the various commodities brought to the city, the Romans paid gold and silver, as they had nothing else to export in return. The money which they had exacted as tribute, or which they had obtained by plunder, was thus returned to the nations from which it had been taken.

23. The subjected provinces continued to pour their choicest productions into Rome, so long as she retained the control of the empire; in this way contributing to enervate, by the many luxuries they afforded, the power by which they had been subdued. The *eternal city*, as she is sometimes called, in the days of her extensive dominion contained about three millions of inhabitants; and, although this immense population was chiefly supplied by importations, the Romans never esteemed the character of a merchant;—they despised the peaceful pursuits of industry, whilst they regarded it honourable to attack without provocation, and plunder without remorse, the weaker nations of the earth.

24. In the year 328 of the Christian era, Byzantium was made the seat of government of the Roman empire by Constantine, who, with a view of perpetuating his own

name, called his new capital Constantinople. However necessary this removal may have been, to keep in subjugation the eastern provinces, it was fatal to the security of the western division. The rivalry between the two cities produced frequent contests for dominion; and these, together with the general corruption and effeminacy of the people themselves, rendered it impossible to resist the repeated and fierce invasions of the barbarous people from the northern parts of Europe.

25. These invasions commenced in the latter part of the fourth century; and, in less than two hundred years, a great portion of the inhabitants was destroyed, and the whole Western Empire was completely subverted. The conquerors were too barbarous to encourage or protect commerce; and, like the arts of peace and civilization generally, it sunk, with few exceptions, amid the general ruin.

26. The empire of Constantinople, or, as it is usually called, the Eastern empire, continued in existence several centuries after the Western Empire had been overrun; and commerce continued to flow, for a considerable time, through some of its former channels to the capital. At length, the Indian trade, which had so long been carried on chiefly through Egypt by the Red Sea, was changed to a more northern route, through Persia.

27. Soon after the commencement of the pretended mission of Mohammed, or Mahomet, in 609 of the Christian era, the power of the Arabians, since called Saracens, began to rise. The followers of the Prophet, impelled by religious zeal, and allured by plunder, in less than 150 years extended their dominion almost to the borders of China on the one side, and to the Mediterranean and Atlantic on the other. The *trade of the East*, of course, fell into their hands; and they continued to enjoy it, until they, in turn, were subdued by the Turks.

28. So great was the prejudice of the Christians against the followers of Mohammed, that, for a long time, it was considered heretical for the former to trade with the latter; but the Saracens having a vast extent of territory, and having control of the Mediterranean and Red Seas, as well as of the Persian Gulf, carried on an extensive trade among themselves.

29. The first European power which rose to commercial eminence, after the destruction of the Western Empire, was the republic of Venice. This important city owed its origin to some fugitives, who fled for their lives to a number of small islands in the Adriatic Sea, during the invasion of Italy by the Huns, under Attila, in the year 452.

30. The houses first built by the refugees, were constructed of mud and seagrass; and, so insignificant were they in their appearance, that a writer of that period compares them to a collection of the nests of water-fowls. The number of these islands, on which so splendid a city was afterwards built, was, according to some, seventy-two; but according to others, ninety, or even one hundred and fifty. For a considerable time, the distinction of rich and poor was not known; for all lived upon the same fish-diet, and in houses of similar form and materials.

31. In less than a century, the inhabitants of these islands had established a regular government; and, in the year 732, we find them venturing beyond the Adriatic into the Mediterranean, even as far as Constantinople, trading in silks, purple draperies, and Indian commodities. In 81[illegible], the French commenced trading to Alexandria, and, in a few years, the Venetia

which the queen paid to this means of defence, gave animation to all maritime concerns. Under her patronage, several companies for trading in foreign countries were formed, which, at that time, and for a long period afterwards, were very beneficial to trade in general. In her reign, also, the colonial system of England had its origin, which contributed eventually, more than any thing else, to the commercial prosperity of that nation. Since the reign of this wise and judicious princess, the commerce and manufactures of Great Britain have been, with a few interruptions, steadily advancing; and, in these two particulars, she surpasses every other nation.

47. The United States possess superior local advantages for trade, and embrace a population unsurpassed for enterprise and energy. Since the Revolution, the resources of our country have been rapidly developing. Our exports and imports are already next in amount to those of Great Britain and France; and the extensive improvements which have been made by the different states, to facilitate internal intercourse, are increasing them with great rapidity.

48. The banking system is very intimately interwoven with commercial affairs in general. Banks are of three kinds, viz. of *discount*, of *deposit*, and of *circulation*. The term *bank*, in its original application, signified a place of common deposit for money, and where, in commercial transactions, individuals could have the amount, or any part of the amount, of their deposits transferred to each other's accounts.

49. The term *bank* is derived from the Italian word *banco*, which signified a kind of bench, or table, on which the Jews were accustomed to place the money that they proposed to lend in the markets of the principal towns. The first bank was established in Venice, about the middle of the twelfth century; the Bank of Genoa, in 1345; the Bank of Amsterdam, in 1607; the Bank of Hamburg, in 1619; the Bank of Rotterdam, in 1635. These were all banks of mere deposit and transfer.

50. *Lending houses* may be traced to a very ancient origin. They were, at first, supported by humane persons, with a view of lending money to the poor, on pledges, without interest. Augustus Cæsar appropriated a part of the confiscated effects of criminals to this purpose; and Tiberias, also, advanced a large capital, to be lent for three years, without interest, to those who could give security in lands equal to twice the value of the sum borrowed.

51. In the early ages of Christianity, free gifts were collected and preserved by ecclesiastics, partly to defray the expenses of divine service, and partly to relieve the poor of the church; and the funds thus provided came, at length, to be called *montes-pietatis*,—mountains of piety. This appellation was afterwards applied to the *loaning houses*, established in modern Italy in imitation of those of antiquity.

52. In course of time, the loaning houses were permitted by the Roman Pontiff to charge a moderate interest on a part of their capital, and, finally, upon the whole of it; still, they retained, for a long period, the original denomination of *montes pietatis*. The receiving of interest on loans was declared lawful by the Pope, about the middle of the fifteenth century. Soon after this period, all the cities of Italy hastened to establish these institutions; and their example was, at length, followed in other parts of Europe.

53. But long before the Pope had granted this privilege, individuals were in the habit of loaning money at an exorbitant usury. These were principally Jews and merchants from Lombardy; hence, all persons

in those countries, who dealt in money, came to be called *Lombard merchants.* The prohibitions of the church against receiving interest were eluded, when necessary, by causing it to be paid in advance, by way of present or premium.

54. In the twelfth century, many of the dealers in money were expelled from England, France, and the Netherlands, for usurious practices; and, in order to regain possession of their effects, which they had, in their haste, left in the hands of confidential friends, they adopted the method of writing concise orders or drafts: hence originated bills of exchange, so convenient in commercial transactions.

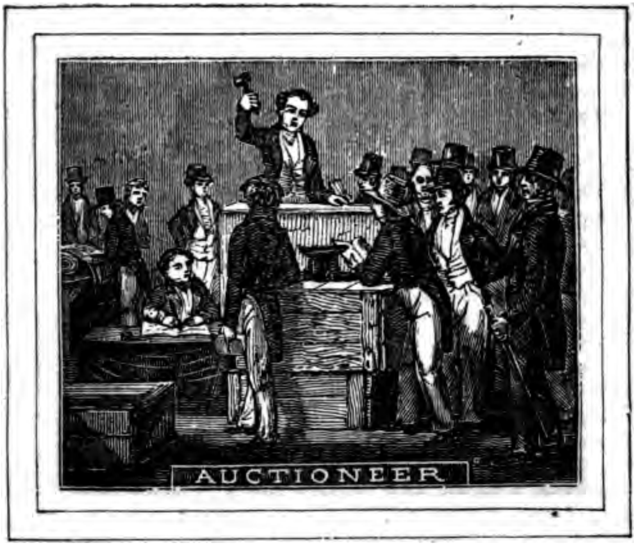
55. The Bank of England was established in the year 1694. Hitherto, the banks of deposit, and loaning houses, were entirely distinct; but, in this institution, these two branches of pecuniary operations were united. It seems, also, that this was the first bank that issued notes, to serve as a medium of circulation, and to supply, in part, the place of gold and silver.

56. In the United States, banking institutions are very numerous. They are all established by companies, incorporated by the legislatures of the different states, or by the congress of the United States. The act which grants the privileges of banking, also fixes the amount of the capital stock, and divides it into equal shares. The holders of the stock choose the officers to transact the business of the corporation.

57. Our banks receive deposits from individual customers; loan money on notes of hand, acceptances, and drafts; issue notes of circulation; and purchase and sell bills of exchange. They are usually authorized, by their charters, to loan three times the amount, and to issue bank notes to twice the amount, of the capital stock paid in. Few banking companies, however, exercise these privileges to the full extent, lest the bank be embarrassed by too great a demand for specie. As soon as a bank ceases to pay specie for its notes, it is said to be broken, and its operations must cease.

58. The Bank of North America was the first institution of this kind, established in the United States. It was incorporated by Congress, in 1781, at the suggestion of Robert Morris. In 1791, after the union of the states had been effected under the present constitution, the first Bank of the United States was incorporated, with a capital of ten millions of dollars. Most of the states soon followed this example; and, before the beginning of the present century, the whole banking capital amounted to near thirty millions of dollars.

59. The charter of the first Bank of the United States expired, by its own limitation, in 1811; and a new one, with a capital of thirty-five millions of dollars, was established in 1816. The number of banks now in successful operation, in this country, including that of the United States, with its various branches, is about 625; and the sum of the whole banking capital, is not far from $220,000,000.



THE AUCTIONEER.

1. **The** Auctioneer is one who disposes of property at public sale, to the highest bidder. The sale of property in this manner, is regulated, in some particulars, by legislative enactments, which have for their object the prevention of fraud, or the imposition of duties.

2. In Pennsylvania, the present law provides for three classes of auctioneers, each of which is required to pay to the state a specified sum for a license. The first class pays two thousand dollars per annum; the second, one thousand; and the third, two hundred; and, besides this, one and a half per cent. on the amount of all their sales is required to be paid into the treasury of the state. To each class are granted privileges corresponding to the cost of the license.

3. In the state of New-York, the number of auctioneers for the cities is limited by law; and they are appointed by the Governor, with the advice and consent of the Senate. They pay to the state a duty of one per cent. on all foreign goods or merchandise. The laws and usages regarding sales at auction, in most of the United States, are similar, in their general principles, to those of Pennsylvania and New-York.

4. A great amount of merchandise, both foreign and domestic, in our principal cities, is sold by auction; and the price which staple commodities there command is generally considered a tolerable criterion of their value at the time. It very frequently happens, however, that articles which are not in steady demand, are sold at a great

sacrifice. Auctioneers seldom import goods, nor is it usual for them to own the property which they sell.

5. In all cases, before an auction is held, due notice is given to the public. This is usually done by the circulation of a printed hand-bill, by a crier, or by an advertisement in a newspaper; or all three of these modes may be employed, to give publicity to one and the same sale.

6. Persons desirous of becoming purchasers at the proposed auction, assemble at the time appointed; and, after the auctioneer has stated the terms of sale, as regards the payment of whatever may be purchased, he offers the property to the persons present, who make their respective bids; he, in the meantime, *crying* the sum proposed: when no further advance is expected, he *knocks down* the article to the last bidder.

7. A mode of sale was formerly, and in some cases is still, practised, in various parts of Europe, called *sale by inch of candle*. The things for sale are offered in the ordinary manner, as has been described in the preceding paragraph, and, at the same time, a wax-candle, an inch in length, is lighted. The purchasers bid upon each other, until the candle has been all consumed; and the last bidder, when the light goes out, is entitled to the articles or goods in question.

8. Auctioneers, in large cities, hold their sales at regular periods; sometimes, every day or evening. On extensive sales of merchandise, credits of two, three, four, six, or nine months, are commonly given. In such cases, the auctioneer gives his own obligations for the goods, and receives in return those of the purchasers.

9. This mode of sale is employed in the disposition of property taken by process of law, for the payment of debts, in every part of the world, where the influence of European law has extended. It is used in preference to any other, because it is the most ready way of sale, and is moreover the most likely method to secure to the debtor something like the value of his property.

10. Executors and administrators often employ this convenient method of sale, in settling the estates of deceased persons; and they, as well as sheriffs and constables, *ex-officio*, or by virtue of their office, have a lawful right to act in the capacity of auctioneer, in performing their respective duties; and no tax is required by the state, in such cases.

11. The sale by auction was in use among the Romans, even in the early days of their city. It was first employed in the disposition of spoils taken in war; hence a spear was adopted as a signal of a public sale; and this continued to be the auctioneer's emblem, even after this mode of sale was extended to property in general. The red flag and spear, or rather the handle of that instrument, both emblematical of blood and war, are still employed for the same purpose.

12. Several attempts have been made in the United States, to suppress sales of merchandise at auction; but these endeavours were unsuccessful, since experience had proved this mode of effecting exchanges to be prompt and convenient; and since some of the states derived considerable revenue from the duties. So long as conflicting interests remain as they are, this mode of sale will be likely to continue.

THE CLERGYMAN.

1. THE Lord Jesus Christ, our Saviour, during his visit of mercy to the world, chose from among his disciples twelve men, to be his especial agents in establishing his church. These men, in our translation of the New Testament, are denominated apostles. The grand commission which they received was, "Go ye into all the world, and preach my gospel to every creature."

2. The apostles commenced their noble enterprise on that memorable day of Pentecost, which next occurred after the ascension of their master; and, in the city of his inveterate enemies, soon succeeded in establishing a church of several thousand members. The doctrines of Christianity soon spread to other cities and countries; and, before the close of that century, they were known and embraced, more or less, in every province of the Roman empire.

3. The apostles, however, were not the only-agents engaged in spreading and maintaining the doctrines of Christianity; for, in every church, persons were found capable of taking the supervision of the rest, and of exercising the office of the ministry. These were ordained, either by the apostles themselves, or by persons authorized by them to perform the ceremony.

4. After the church had passed through a great variety of persecutions, during a period of nearly three centuries the Christians became superior in numbers to the pagans in the Roman empire. In the early part of the fourth century, a free toleration, in religious matters, was de-

clared by Constantine the Great, who took the church under his especial protection.

5. The Christians of the first and second centuries usually worshipped God in private houses, or in the open air, in retired places, chiefly on account of the persecutions to which they were often subjected. It was not until the third century, that they ventured to give greater publicity to their service, by building churches for general accommodation. When the Cross had obtained the ascendency, in the subsequent age, many of the heathen temples were appropriated to Christian purposes, and many splendid churches were erected, especially by Constantine and his successors.

6. In the middle ages, a great number of edifices were erected for the performance of divine worship, which, in loftiness and grandeur, had never been surpassed; and the greater part of these remain to the present day. Some of the most famous churches are, St. Peter's, at Rome; Notre Dame, at Paris; St. Stephen's, at Vienna; the church of Isaac, at St. Petersburg; the minsters at Strasburg and Cologne; and St. Paul's, in London.

7. Up to the time of the great change in favour of Christianity, just mentioned, the whole church had often acted together in matters of common interest, through the medium of general councils; and this practice continued for several centuries afterwards. But the variance and dissensions between the Pope of Rome and the Patriarch of Constantinople, combined with some other causes, produced, about the close of the ninth century, a total separation of the two great divisions of the church.

8. At the time of this division, the whole Christian world had become subject to these two prelates. The part of the church ruled by the Patriarch, was called the *Eastern*, or *Greek Church;* and that part which yielded obedience to the Pope, was denominated the *Western*, or *Latin Church.* Many attempts have been since made to reunite these two branches of the church; but these endeavours have hitherto proved unsuccessful.

9. The conquest of the Roman Empire, so often mentioned in the preceding pages, was particularly injurious to the church, especially that part of it subject to the Roman Pontiff; since it nearly extinguished the arts and sciences, and since the barbarous conquerors were received into the church, before they had attained the proper moral qualifications. From these causes, chiefly, arose the conduct of the church, in the middle ages, which has been so much censured by all enlightened men, and which has been often unjustly attributed to Christianity herself, rather than to the ignorance and barbarism of the times.

10. In the year 1517, while Leo X. occupied the papal chair, Martin Luther, of Saxony, commenced his well-known opposition to many practices and doctrines in the church, which he conceived to be departures from the spirit of primitive Christianity. He was soon joined in his opposition by Philip Melancthon, Ulric Zuingle, and finally by John Calvin, as well as by many other distinguished divines of that century, in various parts of Europe.

11. These men, with their followers and abettors, for reasons too obvious to need explanation, received or assumed the appellation of *Reformers;* and, on account of a solemn protest which they entered against a certain decree which had been issued against them, they also became distinguished by the name of *Protestants.* The latter term is now applied to all sects, of whatever denomination, in the western

division of the church, that do not acknowledge the authority of the Roman See.

12. The Protestant division of the church is called by the Roman Catholics, the *Western Schism*, to distinguish it from that of the Greek church, which is termed the *Eastern Schism.* The Protestants are divided into a great number of sects, or parties; and, although they differ from each other in many of their religious sentiments, they agree in their steady opposition to the Roman Catholics.

13. The ostensible object of the founders of all the churches differing from the Romish communion, has been, to bring back Christianity to the state in which it existed on its first establishment; and to prove their positions in doctrine and church government, they appeal to the scriptures, and sometimes to the Christian writers of the first four or five centuries. The advocates of the "mother church," on the contrary, contend that, being infallible, she can never have departed from primitive principles, on any point essential to salvation.

14. As to the government of the several churches, it is, in most cases, either Episcopal or Presbyterian. In the former case, three orders of clergymen are recognized; viz. *bishops*, *presbyters*, and *deacons;* and these three orders are supposed, by the advocates of episcopacy, to have been ordained by the apostles. This opinion is supported by the circumstance, that these orders are mentioned in the scriptures; and also by the fact, gathered from Christian writers, that they were uniformly established early in the second century.

15. It is supposed, that these three orders of ministers were instituted in the Christian church, in imitation of the Jewish l: the bishop representing the high-priest; the presbyters, the priests; and the deacons, the Levites.

16. On the other hand, the advocates of the Presbyterian form of government, assert, that in the first century of the church, bishop and presbyter were the same order of ministers, and that the former was nothing more than a presbyter, who presided in Christian assemblies, when met to consult on church affairs.

17. The deacons in the churches that have renounced episcopacy, are not classed among the clergy, but are chosen from among the private members, to manage the temporalities of the congregation, or church, to which they belong; to assist the minister, on some occasions, in religious assemblies; or to take the lead in religious worship, in his absence. In this form of government, therefore, there is but one order of clergymen; and this is denominated *presbyter*, *priest*, or *elder*.

18. The literary and religious qualifications required of candidates for orders have varied in different ages of the church, according to the existing state of literature and religion; and the requirements in these two particulars are now different, in the several denominations. Nearly all, however, require the profession in the candidate, that he believes he is moved by the Holy Ghost to take upon him the office of the ministry. Some churches require a collegiate education, with two or three years of the study of divinity; but others, only such as is usually obtained in common schools, combined with a tolerable capacity for public speaking.

19. The clergy in the Roman Catholic church, is of two kinds; the one *regular*, comprehending all the religious of both sexes, who have taken upon themselves monastic vows the other *secular*, com-

prehending all the ecclesiastics who do not assume these obligations. The latter, however, in common with the former, take a vow of perpetual celibacy.

20. It is the especial duty of clergymen, to preach the gospel; to administer the ordinances; and to enforce the discipline of that branch of the church to which they belong. They are also expected to administer consolation to persons in distress of mind, arising from the complicated evils of this life; to unite persons by the bonds of matrimony; and finally, in attending on the burial of the dead, to perform the last ceremony due from man to man.

21. Ministers of the gospel occupy an elevated stand in all Christian communities, both on account of the high tone of moral feeling which they generally possess, and on account of the interest which the people at large feel in the subject of religion. The work of the ministry is emphatically a work of benevolence; and no man can perform it with satisfaction to himself, or with acceptance to the people of his charge, if destitute of love to God and man.

22. In most of the kingdoms of Europe, some one of the several denominations is supported by legal enactments; but in the United States, every branch of the church enjoys equal favour, so far as legislation is concerned. In most cases, the institutions of religion are supported by voluntary contributions or subscriptions.

23. The salary received by ministers of the gospel, in the United States, is exceedingly various in the different denominations, and in the same denomination from different congregations. In some instances, they receive nothing for their services; in others, a liberal compensation.

24. It is but justice to this profession to remark, that, taking the ability of its members into account, there is no employment less productive of wealth; and this is so evidently the case, that some denominations distribute, annually, a considerable amount among the widows and orphans of those who have devoted their lives to the ministry.

25. The meagre support which the ministry usually receives, arises, in part, from the opinion too commonly entertained, that this profession ought to be one of benevolence exclusively, and that ministers should, therefore, be contented with a bare subsistence, and look for their reward in the consciousness of doing their duty, and in the prospect of future felicity. This is a very convenient way of paying for the services of faithful servants, and of relieving the consciences of those whose duty it is to give them a liberal support.

ATTORNEY AT LAW.

1. **Attorney at law**, and lawyer, are synonymous terms, both being applicable to those individuals who transact business of a legal nature for others, who, in this relation, are called *clients*. Before a person is permitted to practise law in our courts, he is required to pass through a regular course of study, and afterwards undergo an examination before persons learned in the law.

2. This profession has its foundation in the numerous and complicated laws which have been adopted by men, to govern their intercourse with each other. These laws, as they exist in our country, may be divided into *constitutional* and *municipal*. Constitutional law is that by which the governments of the United States, and of the different states, have been established, and by which they are governed in their action. The constitution of the United States is the supreme law of the land.

3. Municipal law embraces those rules of civil conduct prescribed by the supreme power of the state, or of the nation; and is composed of *statute* and *common* law. Statute law is the express will of the legislative part of the government, rendered authentic by certain forms and solemnities, prescribed by the constitution.

4. Common law is a system of rules and usages, which have been applied in particular cases of litigation. It originated in the dictates of natural justice, and cultivated reason; and is found more particularly in the reports of the decisions of the courts of justice. The common law is employed, in most cases, to aid in the

construction and definite application of statute law, or positive enactments of the legislature. The common law of England has been adopted by every state in the Union, except Louisiana.

5. The constitution of the United States, and of the several states, provides for three departments of the respective governments, viz. the legislative, the executive, and the judicial. It is the chief province of the first to enact laws, and of the second and third to see that they are duly executed.

6. The judicial power of the United States is vested in one *supreme court* and two inferior courts. The supreme court is now composed of seven justices, who commence their session in the Capitol, at Washington, on the second Monday in January. The two inferior courts are the *district* and *circuit courts:* in the first of these presides a single judge; in the second, one of the justices of the supreme court, and the district judge.

7. The judiciary of the United States takes cognisance of all cases which arise under the constitution, laws, and treaties, of the United States, and likewise of those cases arising under the law of nations. It also embraces all cases of admiralty and maritime jurisdiction, as well as those controversies to which the government of the United States is a party; the controversies between two states; between a state and citizens of another state; between citizens of different states; and between a state or citizens thereof, and foreign states, citizens, or subjects.

8. The judicial systems of all the states correspond, in many respects, with each other. In all, the office of justice of the peace is similar. To these magistrates, the general police of the counties is chiefly committed, as they have authority to cause criminals, and other disturbers of the peace, to be arrested; and, if the offence is small, to fix the penalty; but if the offence is too great to be brought within their jurisdiction, they commit the offenders to prison, to be reserved for trial before the proper tribunal.

9. In many of the states, the common magistrates of the county, or a select number of them, form a court, called county sessions, which has a comprehensive jurisdiction in matters of police, and in regulating the affairs of the county; such as building court-houses, assessing county taxes, opening roads, and licensing taverns.

10. In Virginia, the county sessions is an important court: its jurisdiction extends to many criminal cases, and to those of a civil nature involving the amount of $300. Although a great amount of business passes through these courts, the justices discharge all their duties without compensation. In most of the states, the common magistrates, in their individual or collective capacity, have jurisdiction over civil cases, varying in their greatest amount from thirteen to one hundred dollars; a right of appeal being reserved to a higher court.

11. No definite qualifications are required, by law or usage, for practising in the magistrates' courts: accordingly, there are many persons who plead causes here, who do not properly belong to the profession of law; these are called *pettifoggers*, and the practice itself, by whomsoever performed, is called *pettifogging*. Lawyers of inferior abilities and acquirements are, also, frequently termed pettifoggers.

12. In all the states, a class of county courts is established, denominated courts of common pleas, county courts, district or circuit courts, which have original jurisdiction of civil actions at law, or indictments for crimes. Over these are established the superior or supreme courts, or

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[illegible] management of [illegible] a great [illegible] and [illegible] which [illegible] of [illegible] impres- [illegible] in the subject [illegible]

[illegible] account [illegible] responsibility. [illegible] oppressed [illegible] maintaining their rights. [illegible] profession, also, is much as [illegible] the American people may confidently [illegible] for the maintenance of correct political principles.

The PHYSICIAN.

THE PHYSICIAN.

1. Among the various avocations of men, that of the physician deserves to be placed in the foremost rank. The profession is founded in the multiplicity of diseases to which humanity is liable, and in the medical qualities of certain substances, which have been found to supply a remedy.

2. It is implied, though not expressly declared, in the scriptures, that the diseases and other calamities pertaining to our earthly condition, originated in the fall of man from his pristine innocence; and the Grecian fable of Pandora's box appears to have originated in a similar tradition. It seems that Jupiter, being angry at Prometheus, ordered Vulcan to make a woman endowed with every possible perfection. This workman having finished his task, and presented the workmanship of his hands to the gods, they loaded her with presents, and sent her to Prometheus.

3. This prince, however, suspecting a trick, would have nothing to do with her; but Epimetheus was so captivated with her charms, that he took her to be his wife. The curiosity of Epimetheus, too, led him to look into the fatal box, which he had no sooner opened, than there issued from it the complicated miseries and diseases, which have since afflicted the family of man. He instantly shut the box; but all had flown, save Hope, which had not time to escape; and this is consequently the only blessing that permanently remains with wretched mortals.

4. Since the introduction of moral evil into the world, it cannot be supposed that man has ever enjoyed the blessing of

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[illegible] records of medicine were [illegible] the temples dedicated by the [illegible] on account of [illegible] was honoured as the [illegible]. The name or description [illegible] disease, and the method of cure, [illegible] on durable tablets, which [illegible] where they could be read by visitors.

[illegible] which had been assigned to them by the government.

11. The acquisitions of the Greeks in medical science at length became the inheritance of the Romans: but Rome had existed 535 years before a professional physician was known in the city. This inattention to the subject of medicine arose, chiefly, from an opinion common to the semi-barbarous nations of those times, that maladies were to be cured by the interposition of superior beings. The sick, therefore, applied to their idolatrous priests, who offered sacrifices to the gods in their behalf, and practised over the body of the patient a variety of magical ceremonies.

12. Sacrifices were especially offered to the gods in cases of pestilence; and, on one occasion of this kind, a temple was erected to Apollo, who was regarded as the god of physic; and, on another, Esculapius,

under the form of a serpent, was conducted from Epidaurus, in Greece, and introduced, with great pomp, upon an islet in the Tiber, which was thenceforth devoted to his particular service.

13. Archagathus, a Greek, was the first who practised physic, as an art, at Rome; and he was soon followed by many more of his professional brethren. These pioneers of medicine, however, were violently opposed by Cato the Censor, who publicly charged them with a conspiracy to poison the citizens. But the patients under their care generally recovering, he began to regard them as impious sorcerers, who counteracted the course of nature, and restored men to life by means of unholy charms.

14. Cato having succeeded in producing a general conviction, that the practice of these physicians was calculated to enervate the constitutions, and corrupt the manners of the people, restrictions were laid upon the profession, and practitioners were even forbidden to settle at Rome. But after the people had become more vicious and luxurious, diseases became more frequent and obstinate, and physicians more necessary. The restrictions were, therefore, at length removed.

15. Among the Roman writers on medicine, Celsus was the first who is worthy of consideration. He has been denominated the Roman Hippocrates, because he imitated the close observation and practice of that physician. His work, as well as that of his great prototype, is read with advantage, even at the present day. He flourished at, or near, the time of our Saviour.

16. In the second century of the Christian era, Galen, a Greek physician from Pergamus, and a disciple of the Alexandrian school, settled in Rome. He was learned in all branches of medicine, and wrote more copiously on the subject generally, than any other person amongst the ancients. For 1300 years, his opinions were received as oracular, wherever medicine was cultivated.

17. After the destruction of the Western Empire by the barbarous nations, the science of medicine was cultivated only in the Greek empire, and chiefly at Alexandria, until it began to arrest the attention of the Arabians, in the seventh century. The works of several Greek philosophers and physicians were translated into Arabic, under the patronage of the caliphs; several of whom were zealous promoters of learning.

18. In the eighth century, the caliph Almansur established, at Bagdad, a hospital for the sick, and an academy; in the latter of which, among other branches of knowledge, was taught the medical art. But it was in Spain, that Arabian learning rose to the highest point, and produced the most successful results. The university of Cordova became the most celebrated in the world, and continued to maintain its reputation for a long series of years. Arabian medicine reached its greatest eminence, in the eleventh century.

19. In the tenth century, this science began to be taught in the schools of other parts of Europe; but its professors derived their knowledge of the subject from the Arabian school, or from Arabic translations of the ancient authors; and this continued to be the case until the conquest of Constantinople by the Turks, in 1453. At this time, many erudite Greeks fled into Italy, and carried with them the ancient writings.

20. Before the general revival of this science in Europe, the cure of diseases was chiefly confided, in the western nations of Europe, to the priests and monks,

than at present, generally relied more upon religious ceremonies, and the influence of sacred relics, than upon the application of medical remedies. The superstitions of those barbarous times, respecting the means of curing diseases, have not yet entirely disappeared, even from the most enlightened nations of Christendom.

21. The science of chemistry began to attract much attention about the beginning of the sixteenth century; and the many powerful medical agents which it supplied, at length produced a great change in the theory and practice of medicine. Many valuable medicines of the vegetable kind were also obtained from America. The discovery of the circulation of the blood by William Harvey, in 1628, imparted a new impulse to medicine; but, like chemistry, it gave rise to many absurd and [illegible] theories.

22. Researches in different branches of medicine were continued with ardour in the seventeenth century, in various parts of Europe; and numerous discoveries of [illegible] were made, especially in anatomy. [illegible] theories regarding the origin of diseases and their treatment, were proposed, [illegible], and controverted; but these were overthrown by Stahl, Boerhaave and Hoffman, three eminent theorists of the early part of the eighteenth century.

23. These distinguished men were followed by others of equal celebrity, in the same century, who in part at least, exploded the doctrines of their predecessors. The present century, above all other periods, is remarkable for men eminent in the profession; and although all do not [illegible] [illegible]inion, yet, guided in [illegible] a careful observation [illegible] under the influence of visionary theories than physicians of former times. Besides, many of the subjects of former controversy having been satisfactorily settled, there are now fewer causes of division and excitement among the medical profession.

24. Medical science comprises several branches, of which the following are the principal: viz. Anatomy, Surgery, Materia Medica, Chemistry, the Theory and Practice of Physic. On these subjects, lectures are given in several colleges and universities in Europe, and in the United States. In this country, an attendance on two regular courses of lectures entitles the student to the degree of Doctor of Medicine, provided he can sustain with sufficient ability, an examination before the professors, or, as they are usually termed, the medical faculty.

25. The degree of M. D. conferred by a college or university, is a passport to practice in every state of the Union; and, in some states, none are permitted to attend the sick, professionally, without having first obtained a diploma conferring such degree. In other states, however, no legal restrictions are imposed on the practitioners of the healing art; or, they are licensed by a board of physicians, constituted by law for the purpose.

26. The practice of this profession is generally attended with great labour, and, in many cases, with much perplexity. Diseases are often stubborn, or incurable, and effectually baffle the most skilful practitioner. In most cases, however, diseases are under the control of medical skill; and the high satisfaction which a benevolent physician feels, in relieving the sufferings of his fellow-creatures, may serve as a recompense for the many adverse circumstances which attend the profession.

THE CHEMIST.

1. THIS globe, and every thing appertaining to it, is composed of substances, which exist either in a compound or simple state. It is the object of the scientific chemist to investigate the properties of these substances, and to show their action upon each other. By this science, therefore, compound bodies are reduced to the simple elements of which they are composed, or new combinations formed.

2. According to the preceding definitions, Chemistry comprehends an immense variety of objects. It is scarcely possible to name a thing or phenomenon in the natural world, to which it does not directly or indirectly apply; even the growth of vegetables, and the preparation and digestion of our food, depend upon chemical principles.

3. The word chemistry is supposed to be of Egyptian origin, and, in its primary application, was the same with our phrase natural philosophy. Its meaning was afterwards restricted to the art of working those metals which were most esteemed. In the third century, it came to be applied to the pretended art of transmuting baser metals into gold. The science, in the latter sense of the word, was eagerly cultivated by the Greeks; and from them it passed to the Arabians, who introduced it into Europe under the name of alchymy.

4. The professors of the art were dignified with the appellation of alchymistic philosophers, and the leading doctrine of the sect was, that all metals are composed of the same simple substances; and that, consequently, base metals were capable of

being changed into gold: hence, the chief object of their researches was the discovery of an agent, by which this great change was to be effected. The substance supposed to possess this wonderful property was called "the philosopher's stone;" the touch of which was to change every kind of metal into gold.

5. The greatest rage for alchymy prevailed between the tenth and sixteenth centuries. The writers on this subject who appeared during that period, are very numerous; most of whom are unintelligible, except to those initiated into the art; many of them, however, display great acuteness, and an extensive acquaintance with natural objects. They all boast that they are in possession of the philosopher's stone, and profess the ability of communicating a knowledge of making it to others.

6. Their writings and confident professions gained almost implicit credit, and many unwary persons were thus exposed to the tricks of impostors, who offered to communicate their secret for a pecuniary reward. Having obtained the sum proposed, they either absconded, or wearied out their patrons with tedious and expensive processes.

7. Chemists, for a long time, had supposed it possible to discover, by their art, a medicine which should not only cure but prevent all diseases, and prolong life to an indefinite period, even to immortality. This notion gradually becoming prevalent, the word *chemistry* acquired a more extensive application, and embraced not only the art of making gold, but also that of preparing "the universal medicine." Some of these visionary men asserted, that the philosopher's stone was this wonderful panacea.

8. Few readers need be informed, that *the researches for* the philosopher's stone, and the universal remedy, were, at length, abandoned, as fruitless and visionary; yet the numerous experiments which had been instituted on these accounts, were attended with the incidental advantage of a considerable dexterity in the performance of chemical operations, together with the discovery of many new substances, and valuable facts, which, without these strong incentives, would have remained, at least, much longer in obscurity.

9. Although none of the medicines produced in the chemical laboratory answered the chimerical expectations of the chemists, in curing all diseases, and in rendering the perishable body of man immortal, yet they proved sufficiently valuable in the healing art, to command the attention of the profession all over Europe. The adoption of chemical medicines, however, was, at first, everywhere opposed, either as unsafe remedies, or as being inferior in efficacy to those which had been used for so many centuries.

10. These prejudices having given way to the light of experience, chemical medicines came, at length, to occupy a conspicuous place in the Materia Medica; and their value within the present century has become still more manifest. One of the most useful branches of Chemistry, therefore, is to make the various preparations used in the medical art.

11. The most efficient agent in the introduction of chemical medicines, was Theophilus Paracelsus. This singular individual was born near Zurich, in Switzerland. Having studied chemistry under two masters, he commenced a rambling life, in pursuit of chemical and medical knowledge; and, having visited Italy, France, and Germany, where he met with many whimsical adventures, which contributed greatly to advance his reputation,

he was elected, in 1527, to fill the chair of chemistry, in the University of Basle.

12. One of the first acts of this arrogant professor was to burn, with the utmost solemnity, while seated in his chair, the works of Galen and Avicenna, declaring to his audience, that if God would not impart the secrets of physic, it was not only allowable, but even justifiable, to consult the Devil. He also treated his contemporaries with the same insolence, telling them, in a preface to one of his books, that "the very down on his bald pate had more knowledge than all their writers,—the buckle of his shoes more learning than Galen and Avicenna,—and his beard more experience than all their universities."

13. It could not be expected that a man with such a temper could long retain his situation; and, accordingly, he was driven from it, in 1528, by a quarrel with those who had conferred the appointment. From this time he rambled about the country, chiefly in Germany, leading a life of extreme intemperance, in the lowest company. Nevertheless, he still maintained his reputation as a physician, by the extraordinary cures occasionally effected by his powerful remedies, although his failures were equally conspicuous.

14. But the most signal failure of his remedies occurred in his own person; for, after having boasted for many years of possessing an elixir which would prolong life to an indefinite period, he died, in 1541, at Salzburg, with a bottle of his immortal catholicon in his pocket. The medicines on which Paracelsus chiefly relied, were opium, antimony, and various preparations of mercury. He has the merit of applying the last, especially, to cases in which they had not been before used; and upon this circumstance, his great reputation depended.

15. We have been thus particular in noticing this individual, because he was the first who gave public lectures on chemistry in Europe, and because he gave the first great impulse in favour of chemical medicines. He also carried his speculations concerning the philosopher's stone, and the universal remedy, to the greatest height of absurdity; and, by exemplifying their inutility and fallacy in his own person, he contributed more than any one else to their disrepute and subsequent banishment from the science.

16. Researches for the philosopher's stone, and the universal remedy, having been, at length, relinquished, the chemical facts which had been collected became, in the general estimation, a heap of rubbish of little value. At this time, there arose an individual thoroughly acquainted with these facts, and capable of perceiving the important purposes to which they might be applied.

17. The name of this individual was John Joachim Becher. He published a work in 1669, entitled "Physica Subterranica," by which he gave a new direction to chemistry, by applying it to analyzing and ascertaining the constituent parts of material bodies; and his system is the foundation of the science, as it now exists.

18. George Earnest Stahl, a medical professor in the University of Halle, adopted the theory of Becher, and, after his death, edited the work just mentioned; but he so simplified and improved it, that he made it entirely his own; and, accordingly, it has always been distinguished by the appellation of the Stahlian theory. The principal work of Stahl, on this subject, was published in 1729; and, since

that time, chemistry has been cultivated with ardour in Germany, and in other countries in the north of Europe.

19. In France, chemistry became a fashionable study, about the middle of the eighteenth century: it had, however, been cultivated there by a few individuals, long before that period. Men of eminence now appeared in all parts of the kingdom, and discoveries in the science were made in rapid succession. Some attention was also paid to it in Italy and Spain.

20. In Great Britain, this subject attracted but little attention, except from a few individuals, until Dr. Cullen had become professor of the science, in the University of Edinburgh, in 1756. This accurate investigator of natural phenomena succeeded in enkindling an enthusiasm for chemical investigations among the students; and the subsequent experiments of Dr. Black, Mr. Cavendish, Dr. Priestley, and Lavoisier, which resulted in the discovery of the constituent parts of air and water, diffused the same ardour through every part of the kingdom.

21. Lavoisier, the celebrated French chemist, having proved the Stahlian theory to be incorrect, founded another on the chemical affinities and combinations of oxygen with the various substances in nature. This system has been generally adopted, since it explains a great number of phenomena more satisfactorily than any other ever proposed. The great chemical agent, in the Stahlian system, was supposed to be an inflammable substance, which was denominated by the theorist *phlogiston*. To distinguish, therefore, the new theory from the one which it superseded, it was called the pneumatic or antiphlogistic system.

22. In 1787, a new technical nomenclature was devised, by the aid of which all the chemical facts are easily retained in the memory. Twelve or fifteen terms have been found sufficient for the foundation of a methodical language; and, by changing the terminations of these radicals, or by prefixing certain words or syllables, the changes that take place in bodies are clearly expressed. This valuable innovation originated with Lavoisier and three other French chemists.

23. The present century has been particularly distinguished by numerous and important discoveries in chemical science; but our limits do not permit us to enter into further details: we will merely state, that, among the many eminent men who have devoted their attention to this comprehensive science, Sir Humphrey Davy, of Great Britain, seems to be entitled to the greatest consideration.

24. Chemistry is so extensive in its application, that we will not attempt to describe any of the operations of the laboratory. We, therefore, conclude this article by recommending this science to general attention; assuring the uninitiated, that it is beset with fewer difficulties than they are apt to suppose, and that every effort in the course will be attended with interesting facts and phenomena, which will abundantly reward the labour of investigation.

THE DRUGGIST AND APOTHECARY.

1. The druggist is a wholesale dealer in drugs, which, in commerce, embrace not only articles used or recommended by the medical profession, but also spices, dye-stuffs, and paints. The commodities of his trade are obtained from almost every quarter of the globe; but especially from the countries bordering upon the Mediterranean sea, and from the East Indies and Spanish America.

2. The chemist looks to the druggist for most of the materials employed in his laboratory; and from him the apothecary, physician, and country merchant, obtain their chief supply of medicines. There are, however, but few persons, in the United States, who confine themselves exclusively to this branch of business; for most of the druggists are also apothecaries, and sometimes operative, or manufacturing chemists.

3. Medicinals, when they come into the warehouse of the druggist, are usually in a crude state; and many, or most, of them must necessarily undergo a variety of changes, of a chemical or mechanical nature, before they can be applied in practice. The art by which these changes are effected is called Pharmacy, or Pharmaceutics; and the books which treat of pharmaceutical operations are denominated Pharmacopœias, or Dispensatories.

4. The operations of Pharmacy, which depend upon chemical principles, are conducted chiefly by the operative chemist; but those which consist merely in mechani[illegible]duction, or in mixing together different ingredients, to form compounds, belong

properly to the vocation of the apothecary.

5. The apothecary sells medicines in small quantities, as they may be demanded for immediate appropriation by individuals or in families. Many of the standing compound preparations which have been authorized by the Pharmacopœias, and which are in regular demand, he keeps ready prepared; but a great proportion of his business consists in compounding and putting up the prescriptions of the physician, as they are needed by the patient.

6. In country places, where there are generally no apothecary-shops, the physicians compound and prepare their own prescriptions; but in cities, where these establishments are numerous, the medical profession prefer to rid themselves of this trouble. In most cases, however, they keep by them a few remedies, which can be applied in cases of emergency.

7. In Great Britain, the apothecary is permitted to attend sick persons, and administer medicines, either according to his own judgment, or in conformity with the directions of the physician. He is, therefore, a physician of an inferior order; and, as his fees are more moderate than those of the regular profession, his practice is extensive among persons who, from necessity or inclination, are induced to study economy.

8. The apothecaries in England, Scotland, and Ireland, are obliged to make up their standing medicines according to the formulas of the Dispensatories, adopted in their respective countries; and their shops are subject to the visitation of censors, who have authority to destroy those medicines which they may consider unfit for use,—so that unwholesome or inefficient medicines be not imposed upon the sick. The apothecaries' halls, in France, are also under the supervision of the medical faculty.

9. In the United States, there is no censorship of this kind established by the public authorities; yet the physicians are careful to recommend apothecaries in whom they have confidence, to prepare their prescriptions. The professors in our medical schools are, also, particular in naming to their students those druggists whom they consider men of honour; and omit, at least, to name those who have been detected in selling adulterated medicines.

10. We have, also, an incorporated college of pharmacy both in New-York and Philadelphia, and in each of these, chemical and pharmaceutical lectures are delivered by regular professors. These institutions, although of recent origin, have exerted an important influence in reforming and preventing abuses in the preparation of medicines; and public opinion, especially in the cities, is beginning to render it important for students in pharmacy to obtain a degree from one of these colleges. Under the auspices of the institution at Philadelphia, is published a quarterly journal, devoted to pharmaceutical science.

11. A Pharmacopœia for the United States was formed at Washington, in 1820, by a delegation of physicians from the principal medical societies of the Union. A revision of this work is expected to be made every ten years. Dispensatories, as they exist in this country, are founded upon the Pharmacœpias, and may be properly considered commentaries upon them, since the former contain the whole of the latter, together with more minute descriptions of the sensible and real properties of the medicines, as well as their history and exact mode of preparation.

THE DENTIST.

1. THE human family is subject to a variety of diseases in the teeth, which generally cause the final destruction or loss of these important instruments, unless judicious remedies be applied in proper season. These remedies are administered by the dentist.

2. There are few persons, in proportion to the great mass of the people, who seem to be aware of the utility of dentistry; for, taking the United States together, not more than one person in a hundred ever resorts to the professors of this art, with the view of obtaining a remedy for any dental disease with which he may be afflicted. The common sentiment seems to be, that diseases of the teeth, and their final loss, at different periods of life, are inevitable inconveniences, to which we must submit with the same philosophy with which we meet other misfortunes.

3. To enable readers who have never examined this subject, to comprehend its general nature, we will give a slight sketch of some of the irregularities and diseases to which the teeth are liable; and as we proceed, speak of the remedies applied by the dentist.

4. Two sets of teeth regularly appear, at different periods of life;—one in infancy, and the other at a later period. The first set consists of twenty, and the second of thirty-two teeth; the former are called *infant*, and the latter *adult;* and all these, at the age of six or seven, are upon the jaws at the same time.

5. At the age just mentioned, the infant teeth begin to give way to those which lie

deeper in the sockets, and which are designed to supersede the former. As the new teeth advance, the roots of the first are absorbed; and, after having been thus deprived of their support, they are easily removed,—sometimes, by a slight pressure of the tongue.

6. In a majority of cases, the whole process is carried on by nature with the utmost regularity; but as she is not uniformly successful in this operation, there is no other period at which the teeth of children require so much attention and care. Sometimes the second set rise in the socket without causing the absorption of the roots of the first. In such cases, the former approach in an improper direction; and, unless the latter be removed in season, deformity will be the consequence.

7. When, however, these precautions have been neglected, and the teeth stand in an irregular manner, they can be reduced to symmetry by the dentist, without occasioning much pain. When the front teeth are too much crowded by reason of the restricted dimensions of the jaw, the small teeth, situated next behind the eye or canine teeth, are extracted, one on each side, to give room to the rest.

8. From the ages of six to fifteen years, the teeth of children should be examined, at least once in six months, by a dentist, who, if skilful, can seldom fail of rendering these ornaments of the human countenance regular, healthy, and beautiful. It is customary in England and France, for the proprietors of seminaries of learning to employ a dentist to visit their establishments regularly, for the purpose of performing such operations, and of administering such remedies, as their pupils may require.

9. The teeth are composed of very hard *bone, and enamel. The latter is* a substance exceeding in density any other in the body. It covers the crown of the teeth, and is thickest in those parts which are most exposed to forcible contact in mastication; but in no place is it more than the twelfth of an inch in thickness.

10. The most common disease of the teeth is *caries*, or decay, and almost every part of them is liable to be affected by it; but especially the sides of those in front, and the crowns of those on other parts of the jaws.

11. The disease begins its attack either on the enamel or on the bony portion, and gradually extends itself over the tooth, until it reaches the nerves which supply its natural cavity. These having become exposed to the sudden changes of temperature, and to the contact of extraneous substances in mastication, pain and inflammation are produced, and the extraction of the tooth very commonly becomes the only means of relief.

12. All persons are more or less subject to this disease, but some much more than others; and caries of a peculiar character has been so often traced through whole families, from one generation to another, that it is considered hereditary, as much as any other disease to which the system is liable. In many cases, caries seems to be the effect of some serious disease which affected the constitution, while the teeth were in the early stages of formation.

13. Although the teeth of some individuals possess but little durability; and when caries attacks them, they go on rapidly to decay, in spite of all the aid which science and skill can afford; yet, there are comparatively but few instances in which seasonable and judicious treatment will not arrest the progress of the disease.

14. When the teeth are but slightly affected with caries, especially on the

sides, a cure may be accomplished by the removal of the decayed portion. This is effected, by the most approved dentists, chiefly with small cutting instruments. Formerly, the file and the saw were employed for this purpose, and, by their indiscriminate and injudicious use, many teeth were ruined, and the art of dentistry itself brought into disrepute.

15. Notwithstanding the injuries which have been inflicted by the improper application of the saw and file, in some instances they are indispensable; and, in the hands of the scientific operator, they need not be feared. They are especially useful in preparing the way for the employment of other instruments; for, in some cases, the affected part can with difficulty be reached by any other means. But filing the teeth for the purpose of improving their appearance, or for rendering the sides more accessible to the tooth-pick and brush, seems to be reprobated by the most intelligent part of the profession.

16. When the caries has penetrated far into the tooth, and, in its removal, a cavity of suitable form and dimensions can be produced, it is filled with some substance, with the view of protecting the bone from the action of extraneous agents. The dentist is careful to remove every particle of the decayed portion, and to render the cavity perfectly dry, by repeated applications of lint or raw cotton, before he attempts to fill it.

17. Gold is the only substance which possesses sufficient solidity to withstand the ordinary friction of mastication, and, at the same time, to be capable of resisting the chemical action of the substances which may come in contact with it: yet, lead and tin are frequently employed; and many have been made to believe, that they answer as good, if not a better purpose, than gold itself. The durability of these metals, however, can never be depended upon, and they ought not to be employed when the tooth is capable of resisting the mechanical force required to fill it properly with gold.

18. The metal is prepared for the use of the dentist by the gold-beater, in the manner described in the article which treats upon the business of the latter. The leaves, however, are not beaten so thin as those designed for the common purposes of the arts. The portion to be applied is cut from the leaf, and, after having been twisted a little, is forced into the cavity. The metal is rendered perfectly solid by means of instruments adapted to the purpose.

19. This operation, properly performed under favourable circumstances, generally renders the tooth as serviceable, to the end of life, as if it had never been diseased. The hopes of the patient, however, are sometimes disappointed, by the unskilfulness of the operator, or by the general unhealthiness of the mouth; arising from tartar, other decayed teeth, or want of care in keeping them free from the lodgment of particles of food.

20. It is a common practice to have teeth extracted when they are affected with pain; but this operation is not always necessary. In many cases, the nerve can be paralyzed, and the tooth plugged. By these means, teeth which, under the ordinary treatment, would be prematurely sacrificed, are often retained, for years, in a serviceable state.

21. The next most destructive affection to which the teeth are liable, is the accumulation of *tartar*. This is an earthy substance, deposited from the saliva, and is more or less abundant in different individuals. This deposit is extremely trou-

blesome, and generally does much injury to the mouth, even before those who suffer from it are aware of the mischief.

22. The tartar on the teeth of some individuals, is of a black or greenish colour, and very hard; on those of others, brown or yellow, and not so firm. When it is first deposited, it is soft, and can be easily removed with a tooth-brush; but, if suffered to remain, it soon becomes indurated, and gradually increases in thickness about the neck of the teeth. The gums become irritated and inflamed: the sockets are next absorbed, and the teeth, being left without their natural support, either fall out, or become so loose that they can be easily removed.

23. From this cause, old people lose their teeth, when, in many cases, they are perfectly sound; but comparatively very few are aware of the origin of this deprivation, or suppose that these valuable instruments can be retained in old age. The loss is attributed to the deleterious effects of calomel, or is imagined to be an evil inseparable from advanced age.

24. The affection of the gums, arising from causes just mentioned, is frequently called scurvy, and, like caries, produces fetor of the breath; but when these two diseases are combined, as is frequently the case, they render it extremely offensive. Besides, the effluvia arising from these diseased parts give rise to many maladies which terminate fatally, if a remedy be not applied sufficiently early to save the patient.

25. The obvious remedy for diseases arising from tartar, is the removal of their cause. This is effected by the dentist, with small sharp cutting instruments of a suitable form. To prevent the tartar from accumulating again, and to restore the gums to a healthy state, nothing more is generally requisite than the daily use of a stiff, elastic brush, and the occasional application of some approved dentifrice or astringent wash. Sometimes it may be necessary to scarify, or to apply leeches to the gums.

26. The operations of dentistry, mentioned in the preceding part of this article, are those which relate to the preservation of the teeth; and, if performed in a proper manner, and under favourable circumstances, they will, in most instances, prove successful. But, as few persons resort to the dentist until the near approach of deformity, or until they are impelled by pain to seek relief, a great proportion of dental operations consists in inserting artificial teeth, and in extracting those which are past recovery.

27. When a tooth has gone so far to decay, that it cannot be cured by *stopping*, it should not be suffered to remain in the mouth, lest it infect the rest. Front teeth, however, when the roots remain sound, and firmly based in the sockets, ought not to be extracted, as upon the latter artificial teeth can be placed with great advantage. In such cases, the removal of the crown only is necessary.

28. The instruments commonly employed in extracting teeth, are the key or turnkey, the forceps, the hook, and the graver or punch. These are supposed to be sufficient to perform all the operations of this kind which occur in practice; and, although many attempts have been made to invent others which might answer a better purpose, yet those we have mentioned, in their improved state, are likely to continue in general use.

29. It seems to be a common opinion, that any one can pull teeth who has a turnkey, and sufficient physical strength to use it; accordingly, blacksmiths, barbers, and

medical students, are the chief operators in this line of dental surgery. The many fatal accidents which must inevitably be the consequence, such as breaking the tooth or jaw-bone, are considered matters of course. These, however, seldom happen with skilful dentists; and it is to be regretted, that the latter are not always employed, where unskilfulness may produce such serious consequences.

30. In the cut, at the head of this article, is represented a dentist, about to extract a tooth for a lady, who may be supposed to be in a state of alarm at the sight of the instruments; but he, having thrown his right hand, which holds them, behind him, shows the other containing nothing, with the view of allaying her fears. The manner in which teeth are extracted, needs no description, since it is an every-day operation in all parts of the world.

31. One of the chief sources of income to this profession, is the insertion of artificial teeth; for, although few are willing to expend much to prevent the loss of their teeth, many will incur great expense in supplying the deficiencies, after they have occurred. So perfectly and neatly is this operation performed, by some dentists, that it is difficult to distinguish between teeth which are natural, and those which are artificial.

32. The materials for artificial teeth were formerly found chiefly in the teeth and tusks of the hippopotamus, and in the teeth of some domestic animals; but within a few years, a mineral composition, called porcelain, has come into great repute, since it is very beautiful, and is entirely proof against the most powerful acids.

33. Surgical operations upon the teeth were performed in ancient Greece and Rome, many of which were similar to those of the present day. The extraction of teeth must have been practised at a period of antiquity to which the records of medicine do not reach. The operation is recommended by Hippocrates, who describes many of the diseases to which the teeth are liable. He also mentions the practice of fixing the teeth by means of gold wire, and gives several formulas for making dentrifices.

34. Celsus, a Roman writer on medicine, who flourished about the beginning of the Christian era, seems to have been the first author who described the method of extracting teeth, and the first who notices the removal of tartar by means of cutting instruments, as well as filling carious teeth with lead and other substances, with the view of preventing further decay. Soon after this period, false teeth, of bone and ivory, were introduced. Actius, a writer of the fourth century, is the first who mentions the operation of filing the teeth.

35. The return of barbarism to Europe, nearly extinguished the knowledge of dentistry. As a branch of surgery, however, it was revived by the Arabian writer, Albucasis, in the tenth century; but, for many hundred years after this period, it received but little attention from men of science, the operations of surgery being confined chiefly to the barbers.

36. The first modern work on the diseases of the teeth was published at Lyons, in 1581. This was followed by many other publications on the same subject, in the succeeding century. In the year 1700, it began to be required in France, that all persons who intended to practise dentistry in that country, should undergo an examination, to test their qualifications. From this period is dated, by some, the establishment of the dental art as a distinct branch of medical practice.

THE TEACHER.

1. EDUCATION, in antiquity, was entirely a matter of domestic concern. In countries where priestly or royal despotism prevailed, schools for the benefit of the sons of the great, and for the priests, were established. Moses, the Jewish lawgiver, was educated in a priestly school in Egypt, and Cyrus at a seminary belonging to the Persian court. In Palestine, the scriptures were taught in the schools of the prophets; and, at later periods, in the synagogues, and in the schools of the Rabbies, reading, committing to memory, and hearing explanations of, the sacred books, constituted the chief exercises.

2. In the Grecian cities, boys and girls were taught reading, writing, and arithmetic, in private schools; and, after hav*ing completed the primary course,* those who aspired to higher degrees of knowledge, resorted to the instructions of the philosophers and sophists. This system was commenced as early as 500 years before the advent of Christ.

3. Two hundred years after this period, the Romans began to have primary schools for boys, in the cities; and, from the time of Julius Cæsar, who conferred on teachers the rights of citizenship, they possessed the higher institutions of the grammarians and the rhetoricians. In the former of these, were taught, scientifically, the Latin and Greek languages; and in the latter, young men of talent were prepared, by exercises in declamation, for speaking in public.

4. Children, among the Greeks and Romans, were accompanied to school by

slaves, who, from the performance of this duty, were called *pedagogues;* but, after slaves and freedmen had made acquirements in literature and science, they were frequently employed as tutors: hence the term, at length, came to imply a teacher of children, and it is still used in reference to this employment, although we usually connect with it the idea of pedantry.

5. Until the time of Vespasian, who commenced his reign in the year 70 of the Christian era, the schools were sustained entirely by private enterprise. That emperor instituted public professorships of grammar and rhetoric with fixed salaries, for the purpose of educating young men for the public service; and, in A. D. 150, Antonius Pius founded imperial schools in the larger cities of the Roman Empire. The most celebrated place for the cultivation of science, in the ancient world, was Athens; and to this city, students from all parts of Europe resorted, even as late as the ninth century.

6. Christianity, by degrees, gave a new turn to education; and, in the East, it came gradually under the influence of the clergy. Schools were instituted in the cities and villages for catechumens, and, in some places, those of a higher grade, for the education of clergymen. Of the latter kind, that in Alexandria was the most flourishing, from the second to the fourth century.

7. From the fifth century, these higher institutions began to decline, and others, called cathedral or episcopal schools, seem to have taken their place. In these, besides theology, were taught *the seven liberal arts*—grammar, logic, rhetoric, arithmetic, geometry, astronomy, and music; of which the three first were called the *trivium*, and the four last the *quadrivium*. The text-book employed was the Encyclopœdia of Marcianus Capella, of Africa. This compendium was published at Rome, A. D. 470; and, although a meagre production, it maintained its reputation in the schools of Europe more than 1000 years.

8. The imperial schools, established by Antonius Pius, declined, and finally became extinct in the confusion that followed the irruption of the barbarians; but their places were supplied by the parochial and cathedral schools just mentioned. These, however, were surpassed, in the sixth century, by the *conventual* schools, which were originally designed to prepare persons for the monastic life, but which soon began to be resorted to by laymen.

9. These schools were connected with the convents belonging to the order of St. Benedict, and served as the chief glimmering lights during the darkest period between ancient and modern civilization in Europe. They flourished in Ireland, England, France, and Germany, from the sixth to the eleventh century. The teachers of these seminaries were called *scholastici*, and from them the scholastic philosophy derived its origin and name.

10. In the year 789, Charlemagne, king of the Franks, issued a decree for the improvement of the schools of his empire, and for increasing their number. Not only every bishop's see and every convent, but every parish, was to have its school—the two former for the education of clergymen and public officers, and the latter for the lower classes of people. This monarch instituted an academy of learned men, to whom he himself resorted for instruction, and whom he employed to educate his children, and a select number of the sons of the nobility and distinguished persons.

11. The encouragement which these schools had received from government,

soon discontinued after the death of this monarch, and his school establishment declined like that of Alfred the Great, which was commenced in the ninth century, on a scale of equal liberality. The designs of the English monarch were frustrated by the invasions of the Danes.

12. In the mean time, the Jewish rabbies had schools in Syria and in Northern Africa, as well as in Europe, which contributed to the preservation of ancient learning. Arabian schools were also established, in the ninth century, by the followers of Mohamed, in their Eastern and African caliphates, and in their Moorish dominions in Spain. Through these institutions the mathematical and medical sciences were again revived in Europe.

13. The cathedral and conventual schools continued, for a long time, the principal institutions for education in Europe; and from them proceeded many eminent men. By degrees the light of science began to shine more brightly; teachers of eminence appeared in different places, who collected around them a great number of scholars; and a new kind of schools arose, the heads of which assumed the name of *rectores.*

14. In Paris, several of these teachers gave instructions in various branches, but chiefly in rhetoric, philosophy, and theology. The schools thus collected under different masters, were, in 1206, united under one rector; and, on this account, the whole mass of teachers and scholars was denominated *universitas.* Universities, in other parts of Europe, arose in a similar manner, and some of them about the same time. Those of Oxford and Cambridge, according to some writers, were established about the year 1200; and the two first of these institutions in Germany were founded at Prague and Vienna, the former *in 1348, and the latter in 1365.*

15. The division of the students into four *nations* was an essential feature in the early universities. It arose from the circumstance that the pupils coming from different countries, spoke different languages. Those whose language was the same, or similar, would naturally associate together, and attend the instructions of the same teachers. This division into nations is supposed to have grown up at Paris, previously to the formal union of the several schools under one rector.

16. The first teachers, from whose exertions the universities originated, commenced their public instructions without permission from established authority. Subsequently, the state and university were careful to prevent all persons from giving lectures, who were not well qualified for the employment. Examinations were therefore instituted to determine the capabilities of students. Those who were found competent, received a formal permission to teach, accompanied with certain symbols in the spirit of the age.

17. The first academical degree was that of *baccalaureus;* the second, *licentiatus;* and the third *magister:* the last of these entitled the student to all the privileges of his former teachers, and constituted him one of the *facultas artium—the faculty of the seven liberal arts,* since called the philosophical faculty. The other faculties were those of theology, law, and medicine. The first of these was instituted at Paris in 1259, and the two last in 1260. The faculties elected *deans* from among their number, who, with the *procuratores,* or heads of the four nations of students, represented the university.—These representatives possessed the power of conferring degrees in the different departments of literature and science.

18. Among the public institutions of the

early universities were the colleges, (*collegia*,) buildings in which students, especially those who were poor, might live together, under superintendants, without paying for their lodging. In some cases, they received their board, and frequently other allowances, gratis. These institutions were commenced at Paris; but here, as well as in other places, they did not continue the asylums of the necessitous only. In France and England, the buildings of universities are composed chiefly of these colleges, in which the students reside, and in which the business of instruction is mainly carried on.

19. The teachers in the universities were at first paid for their services by the students. At a later period, the magistrates of the town or city where the institution was located, made presents to eminent scholars, to induce them to remain. This practice finally led to the payment of regular salaries. From and after the fourteenth century, universities were not left to grow up of themselves as formerly, but were expressly established by public authorities, or by the popes.

20. The inactivity and luxury of the clergy, had led to the neglect of the old seminaries of learning. The universities were therefore necessary, not only to revive the taste for science and literature, but also to form a new body of teachers. These institutions, however, at length became subject to undue clerical influence, since the monks obtained admission into them as teachers, and then laboured to increase the importance of their several orders, as well as the power of the Roman pontiff.

21. The monks, also, connected with their convents popular schools, and undertook the education of the children in the cities. But their method of instruction was exceedingly defective, since the intelligent investigation of the subjects studied was little encouraged, and since the memory of the pupils was brought into requisition to the almost entire exclusion of the other faculties of the mind.

22. In the lower parish schools, the children were not permitted to learn to write, the monks being desirous of confining to the clergy the practice of this art, which was very lucrative before the invention of printing. The art was called *ars clericalis;* and, for a long time, the privilege of establishing writing schools for the children of citizens, was a matter of negotiation between the magistrates and the clergy.

23. But the citizens becoming, at length, more independent, the magistrates themselves began to superintend the education of youth. *Trivial* schools were established, in which the *trivium*, reading, and writing, were taught; but for these, as well as for the cathedral and parish schools, which had been neglected for some time by the higher clergy, itinerant monks and students were employed as teachers.

24. The elder pupils of the highest class frequently wandered from one school to another, under the pretence of pursuing their studies, sometimes taking with them younger scholars, whom they compelled to beg or steal, in order to supply their wants. As late as the sixteenth century, Luther complains that these *vacantivi* (or idlers) were the persons chiefly employed as schoolmasters in Germany.

25. A pious fraternity, called Jeronymites, consisting of clergymen and laymen, who lived together, and occupied themselves partly in mechanic arts, and partly in the instruction of youth, exerted considerable influence on education in general. They first established themselves in

Italy, and afterwards in the Netherlands, on the Rhine, and in Northern Germany.

26. Much was done during the last half of the fourteenth century, and in the one hundred years that followed, to encourage the study of the ancient classics. The attention of literary men was turned to these interesting remains of antiquity by the arrival of many learned Greeks, who had fled from Turkish oppression, and who had brought with them the ancient writings.

27. These treasures of former civilization were unfolded to the modern world by the art of printing, which was invented in 1441; and the reformation, which commenced in 1517, also aided the advancement of education. The corporations of the German cities, in which the reformed religion was received, founded seminaries, called *gymnasia*, and *lyceums*, with permanent professorships. A vast amount of property, belonging to the convents and the church, was confiscated by the governments, and appropriated chiefly to the promotion of education.

28. The schools in the countries which adhered to the Roman Catholic religion, however, continued in nearly the same state, until the Jesuit schools arose, towards the end of the sixteenth century. These, on account of the ability with which they were conducted, soon gained the ascendency, and for a long time maintained their reputation; but they at length degenerated, and finally became extinct, on the suppression of the order of Jesuits in 1773.

29. Italy, Spain, and Portugal, have for a long time been inactive in relation to education, it being left entirely to the clergy, and the efforts of the people in *their individual capacity*. Much has been *done in Austria, within fifty years*, to advance this important interest. Under the late emperor, professorships were constituted in the universities and cathedral seminaries for the instruction of teachers; and gymnasia, common and Sunday schools, were established in almost every part of the kingdom.

30. The general organization of schools in France, in the eighteenth century, was similar to that of most other Catholic countries. The government did nothing for the education of the people at large; and the church, which possessed a large proportion of the property of the nation, left the people in total ignorance; whence may have arisen much of the atrocity which marked the early part of the revolution.

31. During the popular reign, the education of youth was declared to be under the care of the state, and many schools, called *polytechnic*, were established. Napoleon, also, afterwards instituted several military schools, and contemplated the introduction of a system of general education. With this view, he instituted an imperial university, which was to have the supreme direction of instruction in France; but his designs were but partially carried into effect.

32. When the Bourbons were again restored to the throne of France, they, with the clergy, laboured to restore the old order of things; and, to keep the common people from becoming dangerous, the Lancasterian schools, established in 1816, were abolished. This condition of things has not been since materially changed; and it is stated, upon satisfactory grounds, that at least one third of the population are unable to read.

33. In England and Ireland, although the middling and higher classes are comparatively well educated, no system of general instruction has ever been estab-

lished for the benefit of the common people. Much, however, has been accomplished by charity and Sunday schools; the former of which were commenced in 1698, and the latter in 1812. Besides these there are numerous charitable foundations on which many persons of limited means have been educated at the higher institutions.

34. In Scotland, more liberal provisions have been made for general education. The system was commenced in the reign of William and Mary, when, by an act of Parliament, every parish was required to maintain a school. The people have so far improved their privileges, that nearly all of the inhabitants of that part of Great Britain can read and write.

35. The government of Russia, during the last and present century, has directed some attention to the promotion of education. According to the decrees of the emperor Alexander, schools of different grades were to be established throughout the empire; but these decrees have been yet only partially executed.

36. In no part of the world has the education of all classes of people been so much attended to as in the United States. This has arisen chiefly from the circumstance, that a remarkable proportion of the colonists were persons of education. This was particularly the case with those of New England, where the instruction of youth, from the very beginning of the settlements, was made a matter of public concern.

37. The principle of making public provision for this purpose, thus early adopted, has never been deserted; on the contrary, it has become so deeply interwoven with the social condition of the people of New England, that there are few families in that part of the Union, which are not within reach of a public school; and, in every state where the influence of the people from that section of country is predominant, public schools have been organized by legal provisions, and a fund has been provided, by which at least a part of the expense of supporting them is paid.

38. In all the states in which these primary institutions are established by legislative enactments, they are kept in operation, in country places, between six and nine months of the year. A *master* is employed in the winter, and a *mistress* in the summer: the former receives for his services from ten to fifteen dollars per month, and the latter, from seventy-five cents to two dollars per week, together with boarding. The teachers, however, during their engagement are compelled to reside in the different families of the *district*, their stay at each place being determined, with scrupulous exactness, by the number of children sent to the school.

39. From the low salaries received for these important services, and the short periods for which engagements are made, it is evident, that teaching a district school cannot be pursued as a regular employment. These schools are therefore supplied by persons who, during the rest of the year, follow some other business; or by students, who rely, in part or entirely, on their own exertions to defray the expenses of their academical, collegiate, or professional education.

40. These schools are, no doubt, institutions of great value; but in the states where they have been established, they are evidently much overrated. They fail in fully accomplishing the ends for which they have been instituted, through the extreme tenacity with which the people adhere to ancient and defective methods of instruction, the frequent change of teachers, and the small compensation allowed

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THE MUSICIAN, AND THE MUSICAL INSTRUMENT MAKER.

THE MUSICIAN.

1. The word *Music*, in its modern application, has reference to the science which treats of the combination of sounds. It is founded upon the law of our nature,—that every leading passion has its peculiar tone or note of expression understood by all human beings. Music, therefore, may be supposed to have been practised in the earliest ages; although it must have been a long time before it arose to the importance of a science.

2. According to the Mosaic records, Jubal, one of the descendants of Cain, played upon musical instruments, many hundred years before the flood. In the early period of the nations of antiquity, and in fact among all semi-barbarous people of later periods, the character of poet and singer were united in the same individual, and the voice was frequently accompanied by musical instruments. The oldest song which has descended to our times, and which is stated to have been exhibited in this manner, was that sung by Miriam, the sister of Moses, on the occasion of the passage of the Red Sea by the children of Israël.

3. The Hebrews employed music in their celebration of religious worship, which consisted, in part, in chanting solemn psalms with instrumental accompaniments. It was also used by them on the occasion of entertainments, as well as in the family circle. It reached its greatest perfection amongst the Jews, in the days of David and Solomon. It is supposed that the priests of Egypt were versed in

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music, before the settlement of the family of Jacob in that country; but how far the Israelites were indebted to them for a knowledge of this pleasing art, is altogether uncertain.

4. Music was held in very high estimation among the Greeks, who attributed to it incredible effects. They even assure us that it is the chief amusement of the gods, and the principal employment of the blessed in heaven. Many of their laws, and the information relative to the gods and heroes, as well as exhortations to virtue, were written in verse, and sung publicly in chorus to the sound of instruments.

5. It was the opinion of the philosophers of Greece, that music was necessary to mould the character of a nation to virtue; and Plato asserts, that the music of his countrymen could not be altered, without affecting the constitution of the state itself. But in his time and afterwards, complaints were made of the degeneracy in this art, and a deterioration of national manners through its influence. The degeneracy probably consisted in its application to the expression of the tender passions; it having been previously applied, in most cases, to awaken patriotic and religious feeling.

6. The invention of music and of musical instruments, as in the cases of most of the arts and sciences among the Greeks, was attributed by the poets to some of the gods, or else to individuals of their own nation. It appears, however, from their traditions, that they received this art, or at least great improvements in its execution, from Phœnicia or Asia Minor. It began to be cultivated scientifically in Greece about 600 years before the advent of Christ.

7. The Romans seem to have derived the music which they employed in religious services from the Etruscans, but that used in war and on the stage from the Greeks. At an early period of their history, it was a great impediment to the progress of the art, that it was practised only by slaves.

8. The Roman orators pitched their voice, and regulated the different intonations through their speech, by the sound of instruments; and on the stage, the song, as well as part of the play itself, was accompanied with flutes. Wind-instruments of various kinds, comprised under the general name of *tibiæ*, and sometimes the cythera and harp, accompanied the chorus. In all these applications of music, the Romans had been preceded by the Greeks.

9. The Hebrews employed accents to express musical tones, but most other nations of antiquity used letters of the alphabet for this purpose; and as they had not yet conceived the idea of the octave or parallel lines, to express a variety of tones in a similar manner by the aid of a key, they required a number of notes that must have been exceedingly perplexing.

10. The Greeks are said to have had about one thousand notes, half of which were for vocal, and the other half for instrumental music. All these were expressed by placing the letters of their alphabet, or parts of them, in different positions. Accents were also used, partly by themselves, and in connexion with the letters.

11. The lines of a poem, set to music, were placed under the letters expressing the tones. The letters for the instrumental part were placed first, and under them those for the voice. The notes of the Greeks and Romans were not required to indicate the time in which they were to be pronounced, since in general the syllables of their language had a natural and distinct quantity. In the cases in which there was a liability to mistake, the sylla-

bles were marked with A, if long, and with B, if short.

12. The Romans expressed the fifteen chief tones of the Greeks with the fifteen first letters of the Latin alphabet; and these were reduced to seven, by Pope Gregory I., towards the end of the sixth century; so that the first seven capital letters were used for the first octave, the small letters for the higher octave, and the same letters doubled, for the highest octave. Parallel lines were soon after invented, on which the letters were written.

13. Musical sounds were expressed in this manner until the year 1024, when, according to some authors, Guido Aretine, a monk of Arezzo, invented points and rhombuses. He also introduced the use of five parallel lines, upon and between which his notes were written. The seven letters which had formerly been used as notes, now became clifs.

14. Still, however, the means of determining the duration of sound belonging to each note, without consulting the quantity of the syllables in the verses to be sung, were yet to be provided. This desideratum was supplied by one Franco, a German of Cologne, who lived towards the end of the eleventh century. Some, however, attribute this improvement to John de Murs. The division of one note into others of less value was invented, in the sixteenth century, by Jean Mouton, chapel-master to King Francis I. of France.

15. The knowledge of music, as a science, was preserved in Europe, after the overthrow of the western empire, through the influence of the church. The apostles, and Hebrew converts generally, had been accustomed to the sacred music of the Jews; and, on this account, it was easy to continue the use of the same psalms and hymns in the Christian church.

16. Many of the Grecian and Roman melodies were also set to words adapted to Christian worship. In regard to the manner of singing, in the early days of the church, it was sometimes in *solo*, sometimes in *alternate strains*, and at other times in *chorus;* in which the whole assembly joined, repeating what had been before sung or read. In the fourth century, with the view of securing the proper execution of this part of divine worship, *precentors* were instituted, who were considered regular officers of the church.

17. Pope Gregory I., surnamed the Great, distinguished himself by establishing a new singing-school, which became a model for many others, in the western division of the church. In consequence of these schools, the singing became more artificial; and this, together with the circumstance that the hymns were in Latin, which had become obsolete, at length excluded the people from any participation in this part of the public worship.

18. Gregory also made a selection of the existing songs of the church, and introduced a *chant*, which, through his influence, and that of his successors, was at length extended throughout Europe. It received the appellation of the *Gregorian chant* from his name. It was also called the *choral song*, because it was sung by a choir. This chant is said to be the foundation of our present church-music.

19. Music, in distinct parts, was not known until after the introduction of the improved method of writing music, invented, as before stated, by Guido Aretine and Franco. The development of harmony, in four parts, was assisted by the *choral;* but it was more particularly advanced by musical instruments, and especially by the organ. In the fifteenth century, music began again to be treated scientifically.

20. The reformation produced great changes in the character of sacred music. Before that event took place, this part of religious worship was confined to a few fixed forms of texts, as in the mass, and this is still the case in the Roman Catholic church; but the Protestants allow great variety both in the poetry and music. Luther's agency in the production of these changes was very considerable. During the seventeenth and eighteenth centuries, church music became continually more brilliant, and always more corrupted, by the intermixture of profane music.

21. In the sixteenth and seventeenth centuries, there grew up, at the courts of the European monarchs, the free chamber style, from which arose that which was afterwards used in the theatre. The opera, which originated with three young noblemen at Florence in 1594, has contributed especially to the splendour and variety of modern vocal music; the advancement of which is claimed particularly by the Italians, as that of the instrumental kind is claimed by the Germans and French.

22. The composition of music, and its execution, either vocally or instrumentally, as well as the business of imparting a knowledge of it to others, are embraced in the employment of the musician; although it is seldom that all these branches are practised by one and the same individual. Music is one of the fine arts, and, during the middle ages, was one of the branches of what was then considered a learned education.

23. Since the scientific revival of music, the art has had so many distinguished professors that we will not attempt even to give a list of their names. Their number was know [illegible] art greatly perfected [illegible] ls, called *con*-[illegible] ly in Italy, either at the public expense, or by the liberality of individuals.

THE MUSICAL INSTRUMENT MAKER.

1. THIS artist unites in his business some of the operations of the cabinet-maker, turner, and brazier. He, also, is dependent upon the wire-drawer, and the tanner and currier, for some of his materials. So great, however, is the number of musical instruments, and so different their nature and construction, that the business of making them is divided into several branches; all of which are never pursued, or carried on, by one person. But, without reference to the several divisions of this business, we will proceed to mention or describe the principal instruments which are now in most common use.

2. The *organ* is the largest of all musical instruments, and, in its improved state, so complex that a mere description of it cannot be well understood. Nevertheless, we will endeavour to give the reader some idea of the general principles on which it is constructed.

3. The most essential and prominent parts of this machine are the *wind-chest*, the *pipes*, and the *bellows*. The former of these is an oblong box, made perfectly air-tight, and placed in a horizontal position. The top of this chest is perforated with several rows of holes of different sizes, and into these are inserted the pipes. Those for the higher notes are of a cylindrical form, and are made of a mixture of metals, chiefly of tin and lead; but those designed for the expression of the lowest tones of the base are made of wood, in a square form. The dimensions of these pipes are regulated by a *diapason* or scale.

4. There are as many of these rows of

pipes, which are called ***stops***, as there are kinds of tones in the organ; and to every row or stop is a plug, attached to a slide, which is denominated a *register*, and which is designed to regulate the admission of wind into the pipes. The pipes are also furnished with valves, which can be opened at pleasure, by means of keys similar to those of the piano-forte. Some organs have few, others have many stops; and, in order to regulate the force of sound, most church organs have two or three rows of keys, whereby a greater or less number of pipes may be filled, and the powers of the instrument may be controlled in what is called the *small organ*, or let loose, so as to become the *full organ*.

5. The fingering of an organ is precisely similar to that of the piano-forte, so far as relates to the position of the keys; but, on account of the great number of holding notes in organ music, and the manner in which the sound is produced, the fingers are more kept down; whence it is considered injurious for performers on the piano-forte to practise on the organ, lest that lightness of touch, so necessary for the former instrument, be affected. It is hardly necessary to remark, that during the performance on the organ, the wind-chest is filled by means of the bellows.

6. The structure of the organ is lofty, elegant, and majestic; and its solemnity, grandeur, and volume of tone, have obtained for it a pre-eminence over every other instrument for the sacred purposes to which it has been applied. The largest organ known is in St. Peter's church, at Rome. It has one hundred stops.

7. The church organ was probably suggested by the ***water organ*** of the Greeks, which was invented five or six hundred years before our era. At what period organs began to be employed in churches, cannot now be ascertained. By some, it is said that Pope Vitelianus caused them to be used in Rome in the seventh century. Others are of opinion, that they were not introduced until three hundred years later. But, be this as it may, the church organ was not in common use until the fourteenth century; and now it is very different in its construction from that of early times. It has received many additions and improvements since the beginning of the fifteenth century.

8. The ***hand*** or ***barrel organ*** consists of a movable cylinder, on which, by means of wires, pins, and staples, are marked the tunes which it is intended to perform. These pins and staples, by the revolution of the barrel, act upon the keys within, and give admission to the wind from the bellows to the pipes. The hand organ is so contrived that the revolution of the barrel gives motion to the bellows.

9. There are several instruments belonging to the class of ***horns***, all of which are made of brass or silver. Those of the latter kind of metal are by far the softest in tone, but brass is the material most commonly employed. The chief instruments belonging to this class are the trumpet, the French horn, the bugle, the Kent bugle, the trombone, and the bass-horn. The ***serpent*** seems to be the connecting link between the trumpet and the flute.

10. The instruments classed with the flute, are the common flutes of various keys, German flutes, and several kinds of flageolets. Nearly allied to these are the clarionet, the hautboy, and bassoon. The breath is applied to the flageolet through an ivory tube at the end; and in the three last named instruments, a thin reed, capable of a free vibration, is a part of the mouth-piece.

11. Of the instruments which produce musical sounds by the vibration of strings, there are a great number, of which the following are the principal:—the lyre, the harp, the guitar, the lute, the dulcimer, the harpsichord, the spinnet, the piano-forte, the violin, the violincello, and the base-viol. The strings of the three last are agitated with a bow; but those of this class first mentioned, are vibrated by the thumb and fingers, by some little instrument held in the hand, or by little hammers, moved by keys, as in the piano-forte.

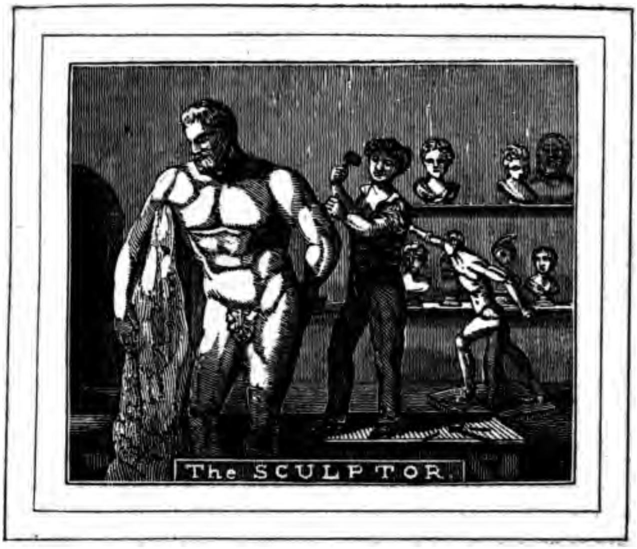
12. The *piano-forte* is said to be the invention of Christian Gottlieb Schroder, of Hohenstein, in Saxony, born in Dresden about the year 1717. Before the introduction of this instrument, the clavichord, harpsichord, and spinnet, supplied its place. On all of these instruments complete harmony can be produced by a single performer, and the most difficult series of tones can be executed with rapidity, by means of a simple mechanism.

13. The *piano-forte* has been gradually improved, until it has become one of the most elegant instruments in the whole compass of musical practice. In firmness and strength of tone, the English piano-fortes formerly surpassed all others; but, within a few years, they have been equalled, and in some respects excelled, by those of American workmanship. The manufacture of this instrument constitutes the most extensive branch of musical instrument-making.

14. The instruments of percussion are the military drum, base-drum, kettle-drum, tabour, tamborine, and the triangle. The kettle-drum has received its name from its conformation. It has but one head, and is used in orchestres, and by the cavalry of modern armies, especially in Europe. The tabour has two heads, about three inches apart, and is beaten with one stick. The tambourine has one head, drawn over a hoop, to which are attached small bells and bits of tin, to make a jingling sound. The time is beaten on the head with the hand.

15. The *bag-pipe* is a wind instrument of high antiquity among the northern nations of Europe, but it has been so long a favourite with the natives of Scotland, that it may be considered their national instrument. It consists of a leather bag and three pipes. The first of the latter is that by which the droning noise is produced, the second emits wind from the bottom of the bag, and the third is that on which the music is made.

16. During the performance on the bag-pipes, the bag is placed under the arm, and worked like a bellows, while the notes are modulated as in a flute or hautboy, by stopping and opening the holes, eight in number, with the ends of the finger and thumb. In some instances, the bag is filled by means of the breath blown into it through a pipe. In Rome, at the time of Advent, the peasants of the mountains express their veneration for the Virgin by playing on this instrument before her image.


The SCULPTOR.

THE SCULPTOR.

1. **Sculpture** is one of the fine arts. In its most extended sense, it includes not only modelling figures in clay, wax, and plaster of paris, and carving them in wood, stone, and marble, but also *casting* them in bronze, lead, or iron, as well as enchasing and engraving.

2. The productions of this art are known under various denominations, but the principal are ***statues***, ***busts***, and ***bas-reliefs***. The first of these are entire representations of men or animals in full relief; the second are upper parts of statues; and the last are figures more or less elevated from the body or ground on which they are formed.

3. The different degrees of elevation in reliefs, are expressed by various terms borrowed from the Italian. A figure is said to be in *alto relievo*, or ***high relief***, when but a small proportion of it is buried in the back-ground; in ***mezzo relievo***, or ***middle relief***, when one half of it is above the surface; and in ***basso relievo***, or ***low relief***, when but little elevated, like figures upon coin. Bas-reliefs are usually applied as ornaments to buildings and pediments to statues.

4. The subjects of sculpture, with a few exceptions, are the same as those of painting; and the course of study essential to proficiency in either, is very similar. They both require much taste and practice, and a thorough knowledge of the human form and other objects frequently represented. The young artist begins with imitating the most perfect models of Grecian art; and, after having become well acquainted

with their beauties, he proceeds to the imitation of nature.

5. When any considerable work in stone or marble is to be done, the sculptor forms a model of clay or wax to guide him in the execution. The soft material is moulded to the proposed form with the hands and small instruments of ivory. The model is by far the most difficult part of the work, and it is here the genius of the artist is to be displayed. The process of copying the model in stone or in any other substance, is an operation merely mechanical, and can often be done by another person as well as by the scientific sculptor himself.

6. The model having been prepared, the block of marble or stone is marked at certain points corresponding to its chief elevations and concavities. The material is then wrought to the rough outline of the figure, by means of strong steel points, drills, and other perforating tools; and the asperities are afterwards removed with chisels, together with rasps and files of different shapes. When a high polish is required, it is produced by friction with pumice-stone, tripoli, and straw ashes.

7. Marble and stone are carved in a similar manner; but the latter, being softer, can be wrought with less difficulty. The defects which may be met with in the stone are repaired with a composition of plaster of Paris and the same stone, pulverized and mixed with water.

8. Casts in plaster of Paris and bronze are taken from models, statues, busts, bas-reliefs, and living persons. To do this, it is necessary to form a mould from the subject to be [illegible] This is done by spread-[illegible] [illegible]ance, which can [illegible] cavities, and [illegible] or cooling. Plaster of Paris is the most usual material employed for this purpose.

9. When the subject is a bas-relief, or any other one-sided figure of a similar kind, the mould can be withdrawn without injury, in a single piece; but if it is a statue, or any other figure of like form, it is necessary to divide the mould into several pieces, in order to a safe removal. These pieces again united constitute a perfect mould. While moulds are being formed on the face of a living person, he breathes through tubes inserted into the nostrils.

10. In taking casts from such a mould, the internal surface is oiled to prevent adhesion, and then plaster mixed with water is poured into it through a small orifice. The mould is afterwards turned in every direction, that the plaster may cover every part of the surface; and when a sufficiency of it has been distributed to produce the requisite strength, and the plaster has acquired the proper solidity, the several pieces are removed from the cast, which, of course, is an exact resemblance of the subject on which the mould was formed.

11. Superfluous portions of the material, produced by the seams in the mould, are removed with suitable instruments, and applications of fresh plaster are made, where necessary to repair blemishes. The cast is finished by dipping it in a varnish made of soap, white wax, and water, and afterwards rubbing it with soft linen. The polish produced in this manner approaches that of marble.

12. The durability of plaster casts, exposed to the weather, is greatly increased by saturating them with linseed oil combined with wax or rosin. They are made to resemble bronze by the application of a soap composed of linseed oil and soda, and

coloured with the sulphate of copper and iron.

13. Moulds are, also, formed of a warm solution of glue, which hardens upon cooling, and such are called *elastic* moulds. This material is sometimes preferred on account of its more easy separation from irregular surfaces. For small and delicate impressions in bas-relief, melted sulphur is sometimes employed; also, a strong solution of isinglass in proof spirits. All three of the substances last mentioned yield sharper impressions than plaster of Paris.

14. Statues designed to occupy situations in which they may be exposed to the weather and mechanical violence, are often made of bronze, cast in moulds. The external portions of the mould are made on the pattern, out of plaster, brick dust, and water. The mould is then covered on the inside with a coating of clay as thick as the bronze is intended to be, and the several pieces are afterwards put together, or *closed*. The internal cavity is next filled with a composition like that on the other side of the clay.

15. When this has been done, the several pieces forming the outside of the mould are separated, and the clay carefully removed. These having been again united, and the core or internal portion of the mould secured in its true position, the whole is bound with iron hoops, and thoroughly dried. The melted bronze is poured into the cavity formed by the removal of the clay, through an aperture made for the purpose. The cast is afterwards rendered smooth by mechanical means.

16. It is conjectured with much reason, that sculpture was one of the arts practised before the deluge, and that it was transmitted to posterity by the survivors of that catastrophe. The first images were probably made for the purpose of perpetuating the memory of the dead; but, in process of time, they became objects of adoration. As the Chaldeans were unquestionably the first idolaters, so are they supposed to have been the first who made progress in sculpture.

17. The first notice of this art in the Mosaic writings, is found in the passage relative to the teraphim, or idols, which Rachael, the wife of Jacob, carried clandestinely, from her father's house: and the first persons mentioned in the bible, as artists, are Aholiab and Bezaleel, who formed the cherubim which covered the mercy-seat, together with some other furniture of the tabernacle, and the sculptured ornaments of the garments of the high-priest.

18. From the same authority, we learn that the nations expelled from Canaan, by the Jewish people, were not ignorant of sculpture and painting; for Moses repeatedly commands the latter to destroy the *pictures* and molten images which might be discovered in their progress through the land. The Israelites crossed the river Jordan about 1500 years before the commencement of our era.

19. From this time to the end of the Jewish polity, we often meet in the scriptures with indications of the fine arts; but the splendour of Solomon's temple, clearly points out the days of that prince as the period in which they had attained their greatest perfection in Judea.

20. The Babylonians, Assyrians, and Phœnicians, became considerably skilful in sculpture, at a very early period, as we learn from early history, and some existing remains. The same remark is also applicable to the inhabitants of Hindostan. But writers have been more particular in

noticing the style of design among the Egyptians, because the progress of the arts among that people is more easily traced, and because it is supposed to elucidate that of most other ancient nations.

21. The chief objects of sculpture, among the Egyptians, were pillars, and other architectural ornaments, idols, the human figure, animals, and hieroglyphics, engraved in a kind of bas-relief on public edifices and the forms of animals. Most of the great works of this nation are supposed to have been executed during and after the reign of Sesostris, who lived in the days of Rehoboam, king of Israel, or about 1000 years before the Christian era.

22. But of all the nations of antiquity, the Greeks were the most distinguished for sculpture. They derived the first rudiments of the art from the Phœnicians, or Egyptians, although they assert that they themselves were its inventors. Its existence, in a rude state, among that people, preceded that of letters, or scientific architecture.

23. Dædalus, who lived about 100 years after Moses, was the first sculptor among the Greeks, of any notoriety. The statues made before his time, were stiff, formal figures, having the arms attached to the body, and the legs united, like the mummy-shaped productions of Egyptian art. He separated the legs of his statues, and placed them, and the upper extremities, in a natural position. He also was the first sculptor who made the eyes of his statues open. On account of these improvements, the Greeks said, that his divine genius made statues walk, and see, and speak.

24. The disciples and imitators of Dælus were called his sons, and artists, *ierally, Dædalides.* Soon after this *od, schools of design* were established in the island of Ægina, at Corinth, at Sicyon, and in Etruria, in Italy: but it seems that no good representations of the human form were effected until near the time of Phidias, who was born 444 years before Christ.

25. This most distinguished of all the votaries of sculpture, flourished at or near the same time with the dramatic poets, Æschylus, Euripides, and Sophocles; the philosophers, Socrates, Plato, and Anaxagoras; and the statesmen and commanders, Pericles, Miltiades, Themistocles, Cimon, and Xenophon. This was the most refined period of Grecian history, and of all others, the most favourable in its moral and political circumstances, for the developement of genius.

26. Phidias was the author of the *ideal style*, which, in the fine arts, may be defined, the union of the perfections of any class of figures. Among the distinguished productions of this artist, the colossal statues of Minerva and Jupiter Olympius, made of gold and ivory, have excited the greatest astonishment. The former, executed for the Parthenon of Athens, was twenty-six cubits in height; and the latter, for a splendid temple at Elis, was about the same height, although seated upon a throne.

27. The favourite disciples of Phidias, were Alcamenes, of Attica, and Agoracritus, of Paros; and at the same time with them, flourished Polycletus, of Argos, Miron, of Bœotia, and Pythagoras, of Rhegium. The *beautiful style* soon succeeded to the ideal; the authors of which, were Praxiteles and Scopas, who brought the art to the highest perfection,—since, in their productions, they united beauty and grace. After the days of these two artists, sculpture began to decline; although it continued to be practised with consider-

able success, for some centuries after this period.

28. The great superiority of the Greeks in the art of sculpture, is ascribed to various causes; among which are classed, their innate love of beauty, and their own elegance of form, combined with the frequent opportunities of studying the human figure, in places where youth were in the habit of performing athletic exercises, in a state of nudity. To these may be added, the practice of awarding to citizens a statue of their own persons, for eminent services to the state, and for excelling in exercises at the public games.

29. The fine arts were nearly extinguished in Greece, by the conquest of the Romans; who, with ruthless rapacity, seized upon, and transferred to their metropolis and villas, the superb works of taste with which the country abounded. By these means, however, a taste for the arts was produced among the Romans, who encouraged with great liberality the Greek artists who resorted in great numbers to their city.

30. The arts at length declined at Rome, and finally became nearly extinct in that city soon after Byzantium was made the capitol of the Roman Empire, in 329 of the Christian era. The new capitol was enriched by the most valuable statuary of the old metropolis, and by a farther pillage of Greece. Artists were also encouraged with a magnificence similar to that of former times; and many new subjects in painting and sculpture, in illustration of the Christian scriptures, were executed as embellishments for the sacred buildings of the city.

31. The art of sculpture necessarily declined during the time of the unsettled state of Europe, which followed the conquests by the barbarous nations. It, however, was not altogether lost, but was occasionally practised, although in a very rude manner, in several kingdoms of Europe. In the eleventh century, after the terrors of the northern invasions had passed away, and the governments had become more established, the arts of design began a regular course of improvement, which has been denominated their revival.

32. This improvement was promoted by means of the frequent intercourse which had sprung up between the commercial cities of Italy and the Greek empire. In 1016, the Pisans founded their great church, called the Dome of Pisa; and, in its construction, they employed many noble pillars and other fragments of Grecian edifices. They also engaged upon the work several Grecian sculptors and painters, who exerted in their service the little skill which had come down from antiquity.

33. The specimens of ancient art thus introduced at Pisa, and the works of these artists, at length incited several Italians to emulation; among whom was Nicolo Pisano, who became the restorer of true taste in the arts, in the thirteenth century. At this period, the crusades had diffused such a zeal for the Christian religion, that magnificent churches were built in every part of Italy, in the designing of which, and in their decoration with sculpture, Pisano and his scholars were universally employed.

34. John Pisano, the son of Nicholo, was also an architect and sculptor of eminence, and by him was built, for king Charles, a castle, and several churches, at Naples. He also executed several pieces of sculpture, and superintended the construction of some edifices in Tuscany. This sculptor, who died in 1320, had several pupils, of whom Agostino and Agnolo Sanesi were the best sculptors of the time.

35. In 1350, an academy of design was formed at Florence by the union of several sculptors, painters, and architects. This institution was called after St. Luke, whom tradition makes a painter by profession. The society was afterwards munificently patronized by the Medici, a noble and wealthy family of that city.

36. From this school, there soon proceeded a great number of skilful artists, among whom were the sculptors Lorenzo Ghiberti, Donatello, and Brunileschi; and after these, others perhaps still more distinguished, until it produced Michael Angelo Buonarotti, who, as a universal genius in the arts of design, has excelled every other artist, whether ancient or modern.

37. This great man was born in Florence, in 1474. His father, having discovered his talent for designing, made him a pupil of Dominic Ghirlandaio, who instructed him in the first principles of the art of drawing. He studied statuary under Bartoldo; and, in his sixteenth year, copied the head of a satyr in marble, to the admiration of all connoisseurs. On account of his great promise, he was liberally patronized by Lorenzo de Medicis, who, besides allowing him a pension, gave him a lodging in the palace, and a place at his table. After the death of this prince, he enjoyed the same favours from his son, Pietro de Medicis.

38. His reputation as an artist having been established at Florence, he was called to Rome by Julius II. From this time, he remained chiefly in the service of the popes, for whom he executed many inimitable works, both of sculpture and painting. He was also an architect of the first order; and, as such, was employed on St. *Peter's* church, as well as on several other public edifices. He died in 1564, at an advanced age.

39. Sculpture, having been brought to as high a state of perfection as it was ever likely to be carried, began to decline in Italy, as it had done before, under similar circumstances, in ancient times; but as barbarism did not again occur to overwhelm it, it did not entirely disappear. It continued to be practised, although in a very inferior degree, until it was again revived by Antonio Canova, near the close of the eighteenth century.

40. The French nation, from its vicinity and intercourse with Italy, obtained from that country the means of improvement in every branch of the fine arts. Accordingly, native artists of considerable merit occasionally appeared. The kings of France, also, often employed Italian architects and sculptors on their great public works. In the reign of Francis I., Leonardo da Vinci, and two other artists from Italy, established a school of fine arts similar to that of St. Luke, at Florence; and the genius of the people, added to national munificence, have kept a respectable school of sculpture to the present time.

41. Considerable ability in sculpture has likewise been exhibited by the native artists of Spain, Germany, Holland, England, and some other countries of Europe; but whatever skill has been displayed in any of these countries has been derived, in an indirect manner at least, from Italy. In the United States, the fine arts have been cultivated with considerable spirit. An academy for this purpose has been established both in New-York and Philadelphia, and a picture gallery has been connected with the Athenæum in Boston, in which the annual exhibition of paintings is respectable.

28. From the time of these great masters, painting gradually declined, although the art continued to be practised by a succession of eminent men, who contended against the blighting influence of the luxury and the internal broils of their countrymen. But soon after Greece became subject to the Roman power, the practice of the fine arts nearly ceased in that country.

29. Before the foundation of Rome, the arts were cultivated, to some extent, in Etruria and Calabria; but the first Roman painter mentioned in history, was Fabius, a noble patrician, who painted, in the year of the city 450, the temple of the goddess Salus, and thereby obtained for himself and family the surname of *Pictor*. Yet the citizens do not seem to have profited by this example; for no other painter appeared among them until 150 years after that period. At this time, Pacuvius, the poet, amused himself, in the decline of life, with painting the temple of Hercules.

30. They were thus inattentive to the cultivation of this, as well as of the other fine arts, because they considered warfare, and the arts which tended directly to support this interest, as alone worthy of the attention of a citizen of their republic; and painting, even after the time of Pecuvius, was considered effeminate and disgraceful. Rome, therefore, can not be said, at any time, to have produced a single artist who could approach the excellencies of those of its refined neighbours, the Greeks.

31. They, however, having ornamented their metropolis and villas with specimens of the arts plundered from the cities of Greece and Sicily, began at length to appreciate their excellencies; and finally, under the first emperors, they encouraged, with great munificence, the Greeks who resorted to their city for employment.

32. But, both sculpture and painting, as well as architecture, declined with Roman civilization. Still, they continued to exist, especially in the Byzantine or Eastern Empire, although in a very inferior state. The art under consideration was preserved chiefly by its application to the purposes of Christianity. It was revived in Italy, in the beginning of the twelfth century, by means of several Grecian artists, who had been employed to ornament the churches, and other edifices at Pisa, Venice, and Florence.

33. The works of Apollonius, one of these Greeks, excited in Giovanni Cimabue a spirit of emulation; and, having been initiated into the practice of the art, he executed a picture of the Virgin Mary, as large as life, for a church dedicated to her, at Florence. This production excited enthusiastic delight in his fellow-citizens, who carried it in procession, with the sound of trumpets, to its place of destination, and celebrated the day as a public feast.

34. Encouraged by this applause, Cimabue pursued the art with ardour; and, although considered a prodigy in his time, his utmost efforts failed to produce tolerable specimens of the art. He, however, far excelled his immediate predecessors; and, by introducing more correct proportions, by giving more life and expression to his figures, and by some other improvements, he became the founder of the art as it exists in modern times. He was born at Florence, in 1240, and died at the age of sixty.

35. The favourite pupil of Cimabue, was Giotto, whom he raised from a shepherd to be a painter; and by him the art

was still more relieved from the Greek imperfections. He abandoned the use of labels as means of distinguishing the different figures of a picture, and aimed at, and attained to, real expression. He marked out to the Italians the course in which the art should be pursued, as Polygnotus had done to the Greeks near 1800 years before; although, like him, he failed in fully exemplifying his principles.

36. His abilities procured him the patronage of Pope Boniface VIII., who employed him at Rome. From this time, the art of painting became attached to the papal dignity, and few succeeding pontiffs have neglected its use. The skill and celebrity of this ingenious artist excited great emulation, and the arts having obtained an earnest of profit and honour, no longer wanted skilful professors or illustrious patrons.

37. In 1350, fourteen years after the death of Giotto, his disciple, Jacopo Cassentino, and nine other artists, founded the Academy of St. Luke, at Florence. This was a grand epoch of the arts; as from this institution arose a large display of talent, increasing in splendour until, within 150 years, it gave to the world, Masaccio, Leonardo da Vinci, Michael Angelo Buonarotti, and Raphael, besides others of great ability.

38. The art advanced but little after the time of Giotto, until the appearance of Masaccio. Under the hand of this great master, painting is said to have been greatly improved; and it was to him that the artists who succeeded were indebted for a more sure and full direction of the course in which they ought to proceed. He was born in 1402, and died in 1443.

39. Leonardo da Vinci, who was born about two years after the death of Masaccio, *brought the art* to still greater perfection; and being endowed with uncommon genius, all the arts and sciences did not seem to afford a field sufficient for the exertion of his talents. He grasped at all, and succeeded far better than his predecessors in everything he undertook; but he wasted much of his time in experiments. Had he confined his great powers to the art of painting, he would probably have never been exceeded.

40. About the year 1410, oil came to be used as a vehicle for paints. It seems to have been first applied to this purpose in Flanders, by John Van Eyck, of Brussels; or it was, at least, first used by him successfully. The first hint of its utility in this application is thought, with reason, to have been obtained from its use as a varnish to pictures painted in water-colours.

41. The art of painting was introduced into Flanders about the time of Giotto, by several Flemings, who had been to Italy for the express purpose of learning it. It was also diffused in practice, about the same time, in Germany; and a particular style of the art grew up in each of these countries. But it was in Italy alone that the art may be said to have flourished in a high state of cultivation; and even there, the principal productions originated from artists of the Florentine school.

42. The art of painting was perfected, perhaps, as far as human ability can carry it, in the first half of the sixteenth century, by Michael Angelo Buonarotti, Raphael, Titian, and Correggio; although it cannot be said that all its excellencies were united in the productions of any one of these distinguished professors: such a union has never yet been displayed, nor can it hardly be expected.

43. The art was essentially aided in its progressive stages of advancement by the liberal patronage of the family of the Me-

dici at Florence, and by the pontiffs at Rome. Angelo and Raphael were both employed at Rome by Julius II. and Leo X., as well as by others who succeeded them in the papal chair, in ornamenting the palaces and sacred buildings. Their productions have never been exceeded in any country, and they still remain the objects of careful study by artists of this profession.

44. Titian was also liberally patronized at Rome, as well as in other parts of Italy, and in Spain and Germany, chiefly as a portrait and landscape painter. The unrivalled productions of these great masters, however, were fatal to the art in Italy, since their superior excellence extinguished emulation, by destroying the prospect of equal or superior success.

45. The flourishing state of the art in Italy, for so long a period, might be expected to have produced a taste for its cultivation in other parts of Europe; but this was the case only to a limited extent. No other countries have yet been particularly distinguished for artists in this branch of the fine arts, except Flanders and Holland; and these were chiefly indebted for the distinction to Peter Paul Rubens, of Antwerp, who was born at Cologne, in 1577, and to Paul Van Rhyn Rembrandt, who was born in 1606, in his father's mill, near Leyden. Some of the scholars of these masters were eminent painters. Anthony Vandyck, a pupil of the former, in particular, is said to have never yet been equalled as a portrait-painter.

46. Very little is known of the art in Spain, until about the year 1500, although it is supposed to have been cultivated with some success before that time. The examples which were left there by Titian produced a favourable impression, and several native artists of considerable eminence afterwards appeared; but the art became nearly extinct in the following age.

47. The proximity of France to Italy, and the employment of Leonardo da Vinci and other eminent artists of Italy by Francis I., together with the establishment of a school of fine arts, as stated in the preceding article, might have been expected to lay the foundation of exalted taste in this kingdom. Nevertheless, the only French painters whose names have come down to us with any pretensions to excellence for one hundred and fifty years, were Jean Cousin, Jaques Blanchard, Nicholas Poussin, and Charles Le Brun. The last, although inferior to Poussin, is at the head of the French school of painting.

48. The successors of Le Brun were not wanting in ability, yet, with a few exceptions, they failed in reaching an enviable eminence in the art, on account of their servile imitation of the false taste of their popular model. The fantastic style of Le Brun became unpopular in France some time previous to the revolution in that country; and another, of an opposite character, and by artists of other nations thought to be equally distant from true taste, has been since adopted.

49. Very little is known of the state of the fine arts in England until the time of Henry VIII., who encouraged the abilities of Hans Holbein, an eminent painter from Switzerland. But painting and sculpture, and particularly the former, having become intimately interwoven with the religion of the church of Rome, they fell into disrepute in England after the change of opinion on this subject in that country. They, however, began to revive in the eighteenth century, and England and English America have since produced some eminent painters, among whom are Hogarth, Reynolds, Opie, West, Copley, Trumbull, and Peale.

THE ENGRAVER.

Engraving is the art of cutting letters or figures in wood, metals, or stone. It was practised in very ancient times, and in different countries, for the purposes of ornament and monumental inscription; but the idea of taking impressions on paper, or on any other substance, from engraved surfaces, is comparatively modern.

THE WOOD ENGRAVER.

1. The Chinese are said to have been the first who engraved figures and letters on wood, for the purpose of printing. The precise time at which they commenced the practice, is totally unknown; but a book prin[illegible] them in the tenth century is [illegible] thought by some an-tiq[illegible]ans derived the art from the Chinese, through the Venitians, who traded in that part of the world earlier than any other Europeans.

2. This opinion is somewhat probable, from the circumstance that the tools employed by the early engravers in Europe, are similar to those used in China; and also, like the Chinese, they engraved on the side of the grain. However this may be, it is certain that the art was practised in various parts of Europe in the fourteenth century. The earliest subjects executed, were figures of saints, rudely engraved in outline. The prints taken from them were gaily coloured, and sold to the common people as original paintings. The principal persons engaged in this traffic were monks, to whom the art was confined for a considerable time.

3. At length, larger subjects, with inscriptions in imitation of manuscript, were executed. The success of these prints gave rise to a more extensive application of the art. Scriptural subjects, of many figures, with texts of scripture, were engraved, and impressions were taken from them on one side of the paper, two sheets being pasted together to form a leaf. Entire sets were bound up together; and thus were formed the first printed books, which, being produced entirely from wood cuts, are known by the name of *block-books.* These books made their appearance about the year 1420.

4. One of the earliest of these productions is denominated "The Apocalypse of St. John;" another "The Poor Man's Bible." But one of the latest and most celebrated, is called "The Mirror of Salvation," published in 1440. Part of the text was printed from solid blocks, and part from moveable wooden types. From this fact, it is easy to discover the origin of printing. After this, most, if not all, of the books, were printed from movable types; but as they were embellished with wood cuts, the demand for such engravings was very much increased, although they were, at first, by no means elegant.

5. Near the close of the fifteenth century, the art began to assume a higher character, principally by the talents of Michael Wolgermuth and William Pluydenwurf. Albert Durer made still greater improvements; and, in 1498, published his celebrated Apocalypse of St. John, printed from folio blocks. Other celebrated engravers succeeded him in the sixteenth century, which may be considered the era when wood engraving was at its highest point of elevation. After this, the art declined, and was considered of little importance, until it was revived in 1775, by the distinguished William Bewick, of Newcastle, England. It is still practised, especially in England and the United States, in a manner which reflects credit on the ingenuity of the age.

6. The earlier artists operated on various kinds of wood, such as the apple, pear, and beech; but these, being too soft, are now used only for calico-printing and other common purposes. The box-wood, on account of its superior texture, is used for every subject that can be termed a work of art. That from Turkey is the best.

7. The engravers, in the infancy of the art, prepared the wood as the common block-cutters now do. The tree was cut the way of the grain, in planks, and of course they engraved on the side of the grain, as upon a board. This mode of preparation enabled them to execute larger subjects. The engravers now prefer the end of the grain, and therefore cut the log transversely.

8. The end on which the engraver is to exert his skill, is planed and scraped, to render the surface smooth, and the block having been cut to the proper size, the drawing is made upon it in India-ink, or with a lead-pencil. The block is now ready for being cut by the artist, who, in the performance of the operation, holds it with one hand, on a cushion made of sand and leather, while, with the other he cuts away the superfluous wood. The part intended to make the impression in printing, is left standing.

9. Wood engravings, well executed, are scarcely inferior to those of copper or steel, and for many purposes they are preferred. They are especially convenient, in that they can be inserted into a page of types, where illustrations or embellishments may be required, and be printed without separate expense. They will also

bear a great number of impressions,—generally 100,000. In this respect, they are decidedly superior to metallic plates. They can likewise be multiplied indefinitely, by the process of stereotyping.

THE COPPERPLATE ENGRAVER.

1. THE engravers on metallic surfaces are termed copperplate engravers, not because copper is the only metal on which they exert their skill, but because it is the one on which they usually operate. The plates are prepared for the artists by the coppersmith, by rubbing them with brick-dust and charcoal, after having cut them of a proper size from sheets of copper.

2. The instruments employed by this artist are few and simple: the principal ones are, the *graver*, the *dry-point*, the *scraper*, and the *burnisher*. The *graver* is a small bar of steel, of a square or lozenge form, and, with the short handle into which it is inserted, about five inches in length. One of the angles of the bar is always on the under side of the instrument, and the point is formed by bevelling the end from the upper side, or angle. The square form is used for broad strokes, and the lozenge for fine ones.

3. The *dry-point*, or needle, is a steel wire with a long cylindrical handle, or it is sometimes of sufficient length and size to be used without a handle. The *scraper* has nearly the form of a triangular pyramid; and the cutting part, which has three edges, is two or three inches long. The *burnisher* has a form nearly conical; and, without the handle, is about three inches long. The last two instruments are frequently made of the same piece of steel, one being forged at each end. In such case, the middle part of the steel is the handle by which they are held.

4. Of engraving on copper, the following are the principal varieties or styles:—1. Line engraving; 2. Stippling; 3. Etching; 4. Mezzotinto; 5. Aquatinta. For the purpose of conveying some idea of these different branches, we will describe them under distinct heads.

5. *Line engraving.* The first thing done, in this species of engraving, is to transfer to the plate an exact copy of the outlines of the design to be executed. In accomplishing this, the plate is moderately heated, and covered with a thin coating of white wax. A piece of transparent paper is then laid over the design to be copied, and traced in outline with a black-lead pencil. The outline thus sketched is turned down upon the coating of white wax, and the whole is subjected to the action of a rolling-press, or is kept for a while under heavy weights. By the application of this pressure, the lines are transferred from the paper to the wax on the plate in a reversed position, which is necessary to make the impression of the finished plate resemble the original.

6. The pencil marks on the wax having been lightly traced on the copper with the dry-point, and the wax having been melted off, a perfect outline is found on the plate. Small subordinate parts of the design are transferred to the plate in the same manner, except that the transparent paper is brought in forcible contact with the waxed surface by means of the burnisher.

7. At this stage of the process, the artist commences the use of the graver. While operating with this instrument, he holds the handle in the palm of his hand, and pushes the point forward with a firm and steady motion, until a line is produced by the removal of a portion of the metal. By a succession of such strokes, judiciously applied, the work is completed. The *burrs*, or

little elevations of the copper, left by the graver on each side of the lines, are removed by means of the scraper and burnisher. Mistakes or blemishes are erased from the plate, either with the burnisher, or by friction with charcoal.

8. *Stippling*. The second mode of engraving is called stippling. This resembles the last method in its process, except that the effect is produced by means of minute punctures or excavations, instead of lines. These are made either with the dry-point or graver. When produced by the former instrument, they are of a circular form; when by the latter, they are rhomboidal or triangular. This style of work is always more slow, and consequently more expensive, than engraving in lines. It has, however, some advantages in the softness and delicacy of its lights and shades, and the prints struck from it approach more nearly to paintings.

9. *Etching*. This mode of engraving is by far more easy than any other, being performed chiefly by chemical corrosion. In fact, any person who can draw, may *etch* coarse designs tolerably well, after having learned the theory of the operation. To perform it, the plate is first covered with a thin coating of some resinous substance, upon which the acid employed can have no action. The design, and all the lines it requires, are next traced on the plate with steel points, called *etching needles*, which are instruments similar to the dry-point.

10. The second part of the process is the corrosion, or, as it is technically called, *biting in*. This is effected by pouring upon the design a quantity of diluted nitric acid, after having surrounded the edges of the plate with a wall of soft wax, to prevent the escape of the fluid. A chemical action immediately takes place in all the lines or points where the copper has been denuded by the needle. After the first biting has been continued long enough, in the judgment of the operator, the acid is poured off, and the plate examined.

11. The light shades, if found sufficiently deep, are then covered with varnish, to protect them from further corrosion. The biting is then continued for the second shades, in the same manner, and afterwards, for the third and succeeding shades, until the piece shall have been finished. The plate having been cleaned, and carefully examined by the aid of a proof impression, the deficiencies which may be discovered are supplied with the graver.

12. *Mezzotinto*. In the production of this kind of engraving, the whole surface of the plate is first roughened, or covered with minute prominences and excavations too small to be obvious to the naked eye; so that an impression taken from it, in this state, would present a uniform velvety black appearance. This roughness is produced mechanically by means of a small toothed instrument, called a *cradle*.

13. When the plate has been thus prepared, the rest of the process is comparatively easy. It consists in pressing down or rubbing out the roughness of certain parts of the plate, with the burnisher and scraper. Where strong lights are required, the plate is restored to a smooth surface; for a medium light, it is moderately burnished, or partially erased; and, for the deepest shades, the ground is left entire, and sometimes etched, and corroded with nitric acid. The productions of mezzotinto plates approach more nearly to oil paintings than any other. This kind of engraving was invented by Prince Rupert, in 1649.

14. *Aqua-tinta.* There are several methods by which this kind of engraving can be executed; we, however, will describe the one which seems to be the most simple and obvious. The outline of the picture having been etched or engraved in the usual manner, the surface of the copper is sprinkled equally with minute particles of rosin. This dust is fixed to the surface by heating the plate until the rosin has melted.

15. The ground having been thus laid, the parts of the plates not intended to be occupied by the design are *stopped out* by means of thick varnish. The plate is now surrounded with a wall of wax, as for etching, and diluted nitric acid is poured upon it. A chemical action immediately takes place, by which the surface exposed between the resinous particles is minutely excavated.

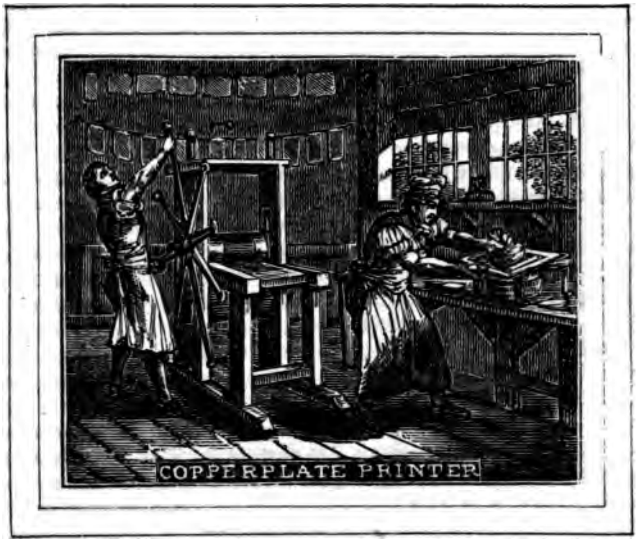
16. The lighter shades are stopped out at an early stage of the process, and the *biting in* is continued for the darker ones. After the plate is judged to be sufficiently corroded, it is cleansed, and an impression taken on paper. The process is then finished by burnishing the shades, to give them greater softness, and, when necessary, by the application of the graver.

17. This mode of engraving is well adapted to light subjects, sketches, landscapes, &c.; but, owing to the fineness of the ground, the plates wear out rapidly, and seldom yield, when of ordinary strength, more than six hundred impressions. The prints taken from such plates bear a strong resemblance to paintings in Indian ink, or drawings in black-lead pencil. Aqua-tinta is the most precarious kind of engraving, and requires much attention on the part of the artist. It was invented by a Frenchman, named Leprince, who, for a time, kept the process a secret, and sold his impressions for original drawings.

18. *Steel engraving.* The process of engraving on steel plates differs but little in its details from that on copper plates; and the chief advantage derived from this method, arises from the hardness or toughness of the material, which renders it capable of yielding a greater number of impressions.

19. This mode of engraving was first practised in England, by the calico-printers; but steel was first employed for bank-notes, and for common designs, by Jacob Perkins, of Newburyport, Massachusetts; and by him, in conjunction with Asa Spencer, of New-London, and Gideon Fairman, of Philadelphia, the use of steel in this application was generally introduced, not only in the United States, but also in Great Britain, some time before the year 1820.

20. The plates are prepared for the engraver from sheets of steel about one-sixth of an inch in thickness. A plate cut from a sheet of this kind is first softened by heating it with charcoal, and suffering it to cool gradually in the atmosphere. It is next *planished*, or hammered on a peculiar kind of anvil, to make it perfectly level, and afterwards ground on one side upon a grindstone. The operation is completed by polishing it with Scotch stone and charcoal. When the engraving has been completed, the plate is not again hardened before impressions are taken from it, as was the case when steel was first substituted for copper.



THE COPPERPLATE PRINTER.

1. The copperplate printer takes impressions on paper from engraved plates by means of a rolling press. This machine, together with some of the operations in its application, are well exhibited in the above picture.

2. The period at which the practice of printing from engraved plates commenced cannot be ascertained with any degree of certainty. The Dutch, the Germans, and the Italians, contend for the honour of introducing it; but the weight of testimony seems to be in favour of the claims of the Italian sculptor and goldsmith, Tommaso Finiguera, who flourished at Florence, about the middle of the fifteenth century.

3. It is stated that this artist, accidentally spilling some melted brimstone on an engraved plate, found, on its removal, an exact impression of the engraving, marked with black, taken out of the strokes. This suggested to him the idea of taking an impression in ink on paper, by the aid of a roller. It is hardly necessary to state, that the experiment succeeded. Copperplate printing was not used in England until about 150 years after its first employment at Florence, when it was introduced from Antwerp, by Speed.

4. The ink used in this kind of printing is made of a carbonaceous substance, called Frankfort black, and linseed or nut oil. Oil is used, instead of water, that the ink may not dry during the process; and it is boiled till it has become thick and viscid, that it may not spread on the paper. The

materials are incorporated and prepared with the stone and muller, as painters prepare their colours.

5. In taking impressions from an engraved plate, it is first placed on an iron frame over a heated stove, or over a charcoal fire in a furnace, and while in this position, the ink is spread over it with a roller covered with coarse cloth, or with a ball or rubber made of the same material, and faced with buckskin. The heat renders the ink so thin that it can penetrate the minute excavations of the engraving. The plate having been thus sufficiently charged, is wiped first with a rag, then with the hand, until the ink has been removed from every portion of it, except from the lines of the engraving.

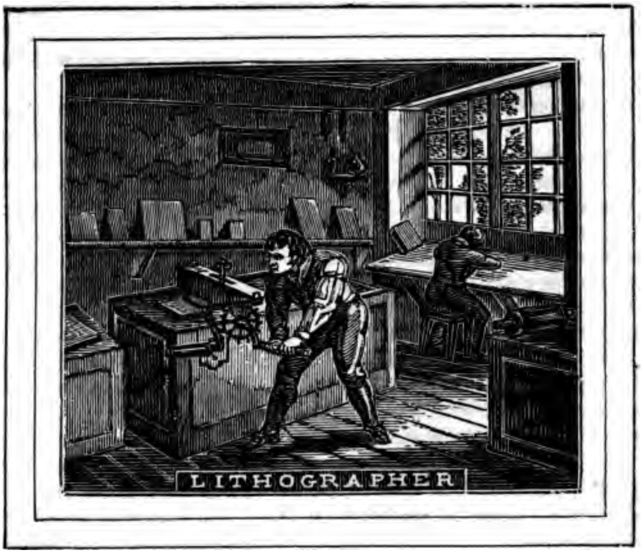
6. The plate is next placed on the platform of the press, with its face upwards, and the paper, which has been previously dampened, is laid upon it. A turn of the cylinders, by means of the arms of the cross, carries the plate under a strong pressure, by which portions of the paper are forced into all the cavities of the engraving. The ink, or part of it, leaves the plate, and adheres to the paper, giving an exact representation of the whole work of the artist. The roller by which the pressure is applied is covered with several thicknesses of broad-cloth.

7. The number of good impressions yielded by engraved copperplates, depends upon various circumstances, but chiefly on the fineness and depth of the work; and these qualities depend mainly upon the style in which it has been executed. Line engravings will admit of four or five thousand, and, after having been retouched, a considerable number more.

8. Plates of steel will yield near ten times as many good impressions as those of copper, and this too without being hardened. Besides, an engraving on steel may be transferred to a softened steel cylinder, in such a manner that the lines may stand in relief; and this cylinder, after having been hardened, may be brought in forcible contact with another plate, and thus the design may be multiplied at pleasure.

9. The bank-note engravers have now a great variety of designs and figures on steel rollers, which they can easily transfer to new plates. This practice, as applied to plates for bank-notes, originated with Jacob Perkins. It is supposed that he must have been led to it by an English engraver in his employ, who may have explained to him the manner in which the British calico-printers produced engravings on copper cylinders. This is not altogether improbable, since the principle in both cases is substantially the same.

10. In consequence of the increased demand for maps and pictorial embellishments in books, as well as for single prints as ornaments for rooms, engraving and copperplate-printing have become employments of considerable importance; and these arts must doubtless continue to flourish to an indefinite extent, in a country where the taste for the fine arts is rapidly improving, and where wealth affords the means of liberal patronage.



THE LITHOGRAPHER.

1. The word lithography is derived from two Greek words—*lithos*, a stone, and *grapho*, to write; and the art to which the term is applied has reference to the execution of letters, figures, and drawings, on stone, and taking from them fac-simile impressions. The art is founded on the property which stone possesses, of imbibing fluids by capillary attraction, and on the chemical repulsion which oil and water have for each other.

2. Every kind of calcareous stone is capable of being used for lithography. Those, however, which are of a compact, fine, and equal grain, are best adapted to the purpose. The quarries of Solenhofen, near Pappenheim, in Bavaria, furnished the first plates, and none have yet been found in any other place, to equal them in quality; although some that answer the purpose tolerably well, have been taken from quarries in France and England.

3. In preparing the stones for use, they are first ground to a level surface, by rubbing two of them face to face, sand and water being interposed. Then, if they are designed for *ink drawings*, they are polished with pumice-stone; but, if for *chalk drawings*, with fine sand, which produces a grained surface adapted to holding the chalk.

4. When stones of proper size and texture cannot be conveniently obtained, slabs are sometimes constructed of lime and sand, and united with the caseous part of milk. The first part of the process which may be considered as belonging peculiarly to the art, consists in making the drawing on the

stone. This is done either in ink, with steel pens and camel's hair pencils, or with crayons made of lithographic chalk. The process of drawing on stone differs but little from that on paper, with similar means.

5. For lithographic ink, a great number of receipts have been given; but the most approved composition consists of equal parts of wax, tallow, shell-lac, and common soap, with a small proportion of lampblack. Lithographic chalk is usually composed of the same materials, combined in different proportions.

6. When the drawing has been finished, the lithographic printer prepares it for giving impressions, by using upon its surface a weak solution of acid and other ingredients, which corrode the surface of the stone, except where it is defended from its action by the grease of the chalk or ink. As soon as the stone has been sufficiently eaten away, the solution is removed by the application of spirits of turpentine and water.

7. The ink employed in this kind of printing, is similar in its composition to other kinds of printing ink. It is applied to the drawing by means of a small wooden cylinder covered with leather. The paper, which has been suitably dampened, is laid upon the stone, and after it has been covered, by turning down upon it a thick piece of leather stretched upon an [illegible] ame, a crank is turned which brings [illegible] ne successively under the press.

[illegible] An impression of the drawing having [illegible] n thus communicated to the paper, the [illegible] et is removed, and the process is re[illegible] ated, until the proposed number of prints [illegible] ve been taken. Before each application [illegible] f the ink, the whole face of the stone is moderately [illegible] water, by means of a spong [illegible] the roller passes over [illegible] f the stone, yet the ink adheres to no part of it, except to that which is covered with the drawing.

9. The number of impresions which may be taken from chalk drawings, varies according to their fineness. A fine drawing will give fifteen hundred; a coarse one, twice that number. Ink drawings and writings give considerably more than copperplates; the finest yielding six or eight thousand, and strong lines and writings many more.

10. Impressions from engravings can be multiplied indefinitely, with very little trouble, in the following manner. A print is taken in the usual way from the engraved plate, and immediately laid with its face upon water. When sufficiently wet, it is carefully applied to the face of a stone, and pressed down upon it by the application of a roller, until the ink is transferred to the stone. Impressions are then taken in the manner before described.

11. The invention of lithography is ascribed to Aloys Senifelder, the son of a performer at the theatre of Munich. Having become an author, and being too poor to publish his works in the usual way, he tried many plans, with copperplates and compositions, in order to be his own printer. A trial on stone, which had been accidentally suggested, succeeded. His first essays to print for publication, were some pieces of music, executed in 1796.

12. The first productions of the art were rude, and of little promise; but, since 1806, its progress has been so rapid, that it now gives employment to a great number of artists; and works are produced, which rival the finest engravings, and even surpass them in the expression of certain subjects. The earliest date of the art in the United States, is 1826, when a press was established at Boston, by William Pendleton.

THE AUTHOR.

1. The word author, in a general sense, is used to express the originator or efficient cause of a thing; but in the restricted sense in which it is applied in this article, it signifies the first writer of a book, or a writer in general. The indispensable qualifications to make a writer are—a talent for literary composition, an accurate knowledge of language, and an acquaintance with the subject to be treated.

2. Very few persons are educated with the view to their becoming authors. They generally write on subjects pertaining to the profession or business in which they have been practically engaged: a clergyman writes on divinity, a physician on medicine, a lawyer on jurisprudence, a teacher on education, and a mechanic on his particular trade. There are subjects, however, which occupy common ground, on which individuals of various professions often write.

3. Authorship is founded upon the invention of letters, and the art of combining them into words. In the earliest ages of the world, the increase of knowledge was opposed by many formidable obstacles. Tradition was the first means of transmitting information to posterity; and this, depending upon the memory and will of individuals, was exceedingly precarious.

4. The chief adventitious aids in the perpetuation of the memory of facts by tradition, were the erection of monuments, the periodical celebration of days or years, the use of poetry, and finally symbolical drawings and hieroglyphical sketches. Nevertheless, history must have remained

uncertain and fabulous, and science in a state of perpetual infancy, had it not been for the invention of written characters.

5. The credit of the invention of letters was claimed by the Egyptians, Phœnicians, and Jews, as well as by some other nations: but as their origin preceded all authentic history not inspired, and as the book of inspiration is silent in regard to it, no satisfactory conclusion can be formed on this point. Some antiquarians are of opinion, that the strongest claims are presented by the Phœnicians.

6. The Pentateuch embraces the earliest specimen of phonetic or alphabetic writing now extant, and this was written about 1500 years before Christ. Many persons suppose, that, as the Deity himself inscribed the ten commandments on the two tables of stone, he taught Moses the use of letters; and on this supposition is founded the claim of the Jewish nation to the honour of the first human application of them.

7. If we may believe Pliny, sixteen characters of the alphabet were introduced into Greece by Cadmus, the Phœnician, in the days of Moses; four more were added by Palamedes during the Trojan war, and four afterwards, by Simonides. Alphabetical writing evidently sprung from successive improvements in the hieroglyphical system, since a great part of the latter has been lately discovered to be syllabic or alphabetic.

8. A considerable number of very ancient alphabets still exist on the monumental remains of some of the first postdiluvian cities, and several of later date, in manuscripts which have descended to our times. The letters employed in different languages have ever been subject to great changes in their conformation. This w [illegible]ially the case before the introduction of the art of printing, which has contributed greatly towards permanency in this respect.

9. The mode of arranging the letters in writing has, also, varied considerably. Some nations have written in perpendicular lines, as the Chinese and ancient Egyptians; others from right to left, as the Jews; and others again alternately from left to right, as was the method at one period among the Greeks. The mode of writing from left to right now generally practised, is preferable to any other, since it leaves uncovered that portion of the page upon which writing has been made.

10. In ancient times, literary productions were considered public property; and consequently, as soon as a work was published, transcribers assumed the right to multiply copies at pleasure, without making the authors the least remuneration. They, however, were sometimes rewarded with great liberality, by princes or wealthy patrons. This literary piracy continued, until a long time after the introduction of the art of printing.

11. In almost every kingdom of Europe, and in the United States, the exclusive right of authors to publish their own productions, is now secured to them by law, at least for a specified number of years. The first legislative proceeding on this subject in England, took place in 1662, when the publication of any book was prohibited, except through the permission of the lord chamberlain. The title of the book, and the name of the proprietor, were, also, required to be entered in the record of the stationers' company.

12. This and some subsequent acts having been repealed in 1691, literary property was left to the protection of the common law, by which the amount of damages which could be proved to have

actually occurred in case of infringement, could be recovered, and no more. New applications were, therefore, made to parliament; and, in 1709, a statute was passed, by which the property of copyright was guarded for fourteen years, with severe penalties. This privilege was connected with the condition, that a copy of the work be deposited in nine public libraries specified in the act.

13. In 1774, the parliament decided that at the end of fourteen years the copyright might be renewed, in case the author were still living. The law continued on this footing until 1814, when the contingency with regard to the last fourteen years was removed, and, if the author still survived, the privilege of publication was extended to the close of his life.

14. In the United States, the jurisdiction of this subject is vested by the constitution in the federal government; and, in 1790, a law was passed by Congress, securing to the authors of books, charts, maps, engravings, &c., being citizens of the United States or resident therein, privileges like those granted in England in 1774. In 1831, the law was altered, and again made to conform to that of England in regard to the period of the privileges. The English and American law differ in no essential provision, except that in the former, no distinction is made between citizens and foreigners.

15. In France, the first statute regarding literary property was passed in 1793, when the right of authors to their works was secured to them during their lives, and to their heirs for ten years after their decease. The decree of 1810 extended the right of the heirs to twenty years. In Russia, the period of copyright is the same as in France, and the property is not liable for the payment of the author's debts.

16. In some of the German States, the right is given for the life-time of the author; in others, it is made perpetual, like any other property; but then the work may be printed with impunity in any of the other states in which a right has not been secured. In Germany and Italy, especially, authors are very poorly remunerated; and in Spain, the book trade has been so much oppressed by a merciless censorship, that authors are compelled to publish their works on their own account.

17. From the preceding statement it appears, that few legislators have been willing to place the productions of intellectual labour on the same honourable footing with other kinds of property. No reason, however, can be assigned for the distinction, except the unjust and piratical usage of two or three thousand years.

18. Authors seldom publish their own works. They generally find it expedient, and, in fact, necessary, to intrust this part of the business to booksellers and publishers, from whom they usually receive a specified amount for the entire copyright, or a certain sum for each and every copy which may be sold during the term of years which may be agreed upon.

THE PRINTER.

1. FROM what has been said in a preceding article, it is manifest that the art of printing arose from the practice of engraving on wood. Letters were cut on wood as inscriptions to pictures, and were printed at the same time with them, by means of a hand-roller. The impressions were taken on one side of the paper; and, in order to hide the nakedness of the blank side, two leaves were pasted together. These leaves were put up in pamphlet form, and are now known under the denomination of *block-books*, because they
printed from wooden blocks.

Although the art of typographical
g can be clearly traced to wood en-
g, yet so much uncertainty rests
ry, that the honour of its in-
d by three cities—Harlem, in Holland, and Strasburg and Mentz, in Germany; and, at the present time, it is difficult to determine satisfactorily the merits of their respective claims. The obscurity on this point has arisen from the desire of the first printers to conceal the process of the art, that their productions might pass for manuscripts, and that they might enjoy the full benefit of their invention.

3. The advocates of the claims of Harlem state, that Laurentius Coster applied wooden types, and some say, even metal types, as early as 1428, and that several persons were employed by him in the business up to the year 1440, when his materials were stolen from him by one of his workmen or servants, named John, while the family were engaged in celebrating

the festival of Christmas eve. The thief is said to have fled first to Amsterdam, then to Cologne, and finally to have settled in Mentz, where, within a twelvemonth, he published two small works, by means of the types which Laurentius Coster had used.

4. These claims in favour of Harlem, however, were not set forth until 120 years after the death of Coster; and the whole story, as then stated by Hadriamus Junius, was founded altogether upon traditionary testimony. Perhaps wood engravings, with inscriptions, may have been executed there; if so, the account may have originated from that circumstance.

5. The statements which seem to be the most worthy of credit, bestow the honour of this invention on a citizen of Mentz. Here, it appears that John Geinsfleisch, or Guttemburg, senior, published two small works for schools, in 1442, on wooden types; but, not having the funds necessary to carry on the business, he applied to John Faust, a rich goldsmith, who became a partner in 1443, and advanced the requisite means. Soon afterwards, J. Meidenbachius and some others were admitted as partners.

6. In the following year, John Guttemburg, the brother of Geinsfleisch, made an addition to the firm. For several years before this union, or from 1436, Guttemburg had been attempting to perfect the art at Strasburg; but it is said that he had never been able to produce a clean printed sheet. The brothers may or may not have pursued their experiments without receiving any hints from each other, before their union at Mentz.

7. Soon after the formation of this partnership, the two brothers commenced cutting *metal types*, for the purpose of printing an edition of the Bible; which was published in Latin, about the year 1450. Before this great achievement of the art had been effected, Geinsfleisch appears to have retired from the concern, some say on account of blindness.

8. The partnership before mentioned was dissolved in 1450, and Faust and Guttemburg entered into a new arrangement, the former supplying money, the latter personal services, for their mutual benefit; but various difficulties having arisen, this partnership was also dissolved in 1455, after a law-suit between them, which was decided against Guttemburg.

9. Faust, having obtained possession of the printing materials, entered into partnership with Peter Shœffer, who had been for a long time a servant or workman in the printing establishment. In 1457, they published an edition of the *Psalter*, which was then considered uncommonly elegant. This book was, in a great measure, the work of Guttemburg, since, during the four years in which it was in the press, he was for two years and a half the chief operator in the printing-office.

10. Guttemburg, by the pecuniary aid of Conrad Humery and others, established another press in Mentz, and, in 1460, published the "*Catholicon Joannis Januensis.*" It was a very handsome work, but not equal in beauty to the Psalter of Faust and Shœffer. The latter was the first printed book known to have a genuine date. From this time, it has been the practice for printers to claim their own productions, by prefixing to them their names.

11. Notwithstanding the great advancement which had been made in the art of printing, the invention cannot, by any means, be considered complete, until about the year 1458, when Peter Shœffer contrived a method of casting types in a matrix or mould. The first book executed

with cast metal types was called "*Durandi Rationale Divinorum Officiorum*," published in 1459. Only the smaller letters, however, were of this description, all the larger characters which occur being *cut types*. These continued to be used, more or less, as late as the year 1490.

12. In 1462, Faust carried to Paris a number of Latin Bibles, which he and Shœffer had printed, and disposed of many of them as manuscripts. At first, he sold them at five or six hundred crowns, the sums usually obtained by the scribes. He afterwards lowered the price to sixty. This created universal astonishment; but when he produced them according to the demand, and when he had reduced the price to thirty, all Paris became agitated.

13. The uniformity of the copies increased the wonder of the Parisians, and information was finally given to the police against him as a magician. He was accordingly arrested, and a great number of his Bibles were seized. The red ink with which they were embellished, was supposed to be his blood. It was seriously adjudged that the prisoner was joined in league with the devil; and had he not disclosed the secret of his art, he would probably have shared the fate of those whom the magistrates of those superstitious times condemned for witchcraft.

14. It may be well to inform the reader, that, although the story of Faust's arrest, as above detailed, is related as a fact by
l authors, yet by others it is thought
unworthy of credit. It is also gene-
supposed that the celebrated romance
Doctor Faustus and the devil" origin-
in the malice of the monks towards
t, whose employment of printing de-
d them of their gain as copiers. It
as more ble, however, that it
from ing performances
of Doctor John Faust, a dealer in the black art, who lived in Germany in the beginning of the sixteenth century.

15. Faust and Shœffer continued their printing operations together, at least until 1466, about which time it is conjectured that the former died of the plague at Paris. Geinsfleisch, or, as he is sometimes called, Guttemburg, senior, died in 1462; and his brother Guttemburg, junior, in 1468, after having enjoyed for three years the privileges of nobility, which, together with a pension, had been conferred upon him by Archbishop Adolphus, in consideration of his great services to mankind.

16. More copies of the earliest printed books were impressed on vellum than on paper; but the method was soon reversed, and paper was used for a principal part of the edition, while a few only were printed on vellum, as curiosities, and to be ornamented by the illuminators, whose ingenious art, though in vogue before and at that time, did not long survive the rapid improvements in printing.

17. We are informed that the Mentz printers observed the utmost secrecy in their operations; and, that the art might not be divulged by the persons whom they employed, they administered to them an oath of fidelity. This appears to have been strictly adhered to, until the year 1462, when the city was taken and plundered by Archbishop Adolphus. Amid the consternation which had arisen from this event, the workmen spread themselves in different directions; and, considering their oath no longer obligatory, they soon divulged the secret, which was rapidly diffused throughout Europe.

18. Some idea may be formed of the celerity with which a knowledge of printing was extended, from the fact that the art was received in two hundred and three

places prior to the year 1500. It was brought to England in 1471, by William Caxton, a mercer of the city of London, who had spent many years in Germany and Holland. The place of the first location of his press was Westminster Abbey. The first press in North America was established at Cambridge, Massachusetts, in 1639.

19. Printed newspapers had their origin in Germany. They first appeared in Augsburg and Vienna, in 1524. They were originally without date or place of impression, nor were they published at regular periods. The first German paper with numbered sheets was printed in 1612; and from this time must be dated periodical publications in that part of Europe.

20. In England, the first newspaper appeared during the reign of Elizabeth. It originated in a desire to communicate information in regard to the expected invasion by the Spanish armada, and was entitled the "English Mercury," which, by authority, was printed at London by Christopher Barker, her highness's printer, in 1588.

21. These, however, were extraordinary gazettes, not regularly published. Periodicals seem to have been first extensively used by the English, during the civil wars in the time of the Commonwealth. The number of newspapers in Great Britain and Ireland amounted, in 1829, to 325, and the sums paid to the government for stamps and duties on advertisements, amounted to about £678,000 sterling.

22. No newspaper appeared in the British colonies of America until 1704, when the "News Letter" was issued at Boston. The first paper published in Philadelphia, was issued in 1719; the first in New-York, in 1733. In 1775, there were 37; and in 1801, there were, in the whole United States, 203; in 1810, 358; at the present time, there are about 1200, and the number is annually increasing.

23. The first periodical paper of France originated with Renaudot, a physician in Paris, who, for a long time, had been in the habit of collecting news, which he communicated verbally to his patients, with the view to their amusement. But, in 1631, he commenced the publication of a weekly sheet, called the "Gazette de France," which was continued with very little interruption until 1827. There are now, probably, in France, about 400 periodical publications, most of which have been established since the commencement of the revolution of 1792.

24. Periodicals devoted to different objects have been established in every other kingdom of Europe; but, in many cases, they are trammelled by a strict censorship of the respective governments. This is especially the case with those devoted to politics or religion. But all Europe, with its 190,000,000 of inhabitants, does not support as many regular publications as the United States, with its 13,000,000.

25. The workmen employed in a printing-office are of two kinds:—*compositors*, who arrange the types according to the copy delivered to them; and *pressmen*, who apply ink on the types, and take off impressions. In many cases, and especially where the business is carried on upon a small scale, the workmen often practise both branches.

26. Before the types are applied to use, they are placed in the cells or compartments of a wooden receptacle called a *case*, each species of letter, character, or space, by itself. The letters which are required most frequently are lodged in the

largest compartments, which are located nearest to the place where the compositor stands while arranging the types.

27. The compositor is furnished with a *composing-stick*, which is commonly an iron instrument, surrounded on three sides with ledges a little less than half an inch in height, one of which is moveable, so that it may be adjusted to any length of line. The compositor, in the performance of his work, selects the letters from their several compartments, and arranges them in an inverted order from that in which they are to appear in the printed page.

28. At the end of each word is placed a *quadrat*, to produce a space between that and the one which follows. The quadrats are of various widths, and being considerably shorter than types, they yield no impression in printing. A thin brass rule is placed in the stick, on which each successive line of types is arranged. When the composing-stick has been filled, it is *emptied* into the *galley*, which is a flat board, partly surrounded with a rim.

29. On this galley, the lines are accumulated in long columns, which are afterwards divided into pages, and tied together with a string, to prevent the types from falling asunder, or into *pi*, as the printers term it. A sufficient number of pages having been completed to constitute a *form*, or, in other words, to fill one side of a sheet of printing-paper, they are arranged on an *imposing-stone*, and strongly locked up, or wedged together, in an iron *chase*.

30. The first impression taken from the types is called the *proof*. This is carefully read over by the author or proof-reader, or both, and the errors and corrections plainly marked in the margin. These cor having been made by the com- rm is again locked up, and e *pressman*.

31. The pressman having dampened his paper with water, and put every part of his press in order, takes impressions in the following manner:—he places the sheet upon the *tympan*, and confines it there by turning down upon it the *frisket*; he then brings them both, together with the paper, upon the form, which has been previously inked. He next turns a crank with his left hand, and thereby places the form directly under the *platen*, which is immediately brought in a perpendicular direction upon the types, by means of a lever pulled with his right hand.

32. After the impression has been thus communicated, the form is returned to its former position, and the printed sheet is removed. The operation as just described is repeated for each side of every sheet of the edition. In the cut at the head of this article, the pressman is represented as in the act of turning down the frisket upon the tympan. The business of the boy behind the press is to apply the ink to the types, by means of the *rollers* before him.

33. Within the present century, great improvements have been made in the printing business generally, and especially in the preeses, and in the means of applying the ink. In the old *Ramage* press, the power was derived from a screw which was moved by a lever; but in those by several late inventors, from an accumulation of levers.

34. In 1814, printing by machinery was commenced in London, and rollers became necessary for inking the forms. These were made of molasses, glue, and tar, in proportions to suit the temperature of the weather. From these originated composition balls in the following year, and in 1819, hand rollers. Formerly the ink was applied by means of pelt balls stuffed with wool.

THE TYPE-FOUNDER.

1. The types cast by the type-founder are oblong square pieces of metal, each having on one end of it a letter or character in relief. The metal of which these important instruments are composed is commonly an alloy consisting essentially of lead and antimony, in the proportion of about five parts of the former to one of the latter. This alloy melts at a low temperature, and receives and retains with accuracy the shape of the mould. Several hundred pounds of type-metal are prepared at a time, and cast into bars filled with notches, that they may be easily broken into pieces, when about to be applied to use.

2. In making types, the letter or character is first formed, by means of gravers and other tools, on the end of a steel punch. With this instrument a *matrix* is formed, by driving it into a piece of copper of suitable size. A punch and matrix are required for every character used in printing. A metallic mould for the body of the type is also made; and, that the workman may handle it without burning his hands, it is surrounded with a portion of wood. The mould is composed of two parts, which can be closed and separated with the greatest facility.

3. The type-metal is prepared for immediate use by melting it, as fast as it may be needed, in a small crucible, over a coal fire. The caster having placed the matrix in the bottom of the mould, commences the operation of casting by pouring the metal into the mould with a small ladle. This he performs with his right hand,

while with the other he throws up the mould with a sudden jerk; then with both hands he opens it and throws out the type. All these movements are performed with such rapidity, that an expert hand can cast about fifty types of a common size in a minute. Some machines have been lately introduced, which operate with still greater rapidity.

4. Each type, when thrown from the mould, has attached to it a superfluous portion of metal, called a *jet*, which is afterwards broken off by hand. The jets are again cast into the pot or crucible, and the types are carried to another room, where the two broad sides are rubbed on a grindstone. They are next arranged on flat sticks about three feet long, and delivered to the *dresser*, who scrapes the two sides not before made smooth on the grindstone, cuts a grove on the end opposite the letter, and rejects from the row the types which may be defective.

5. The whole process is completed by setting up the types in a printer's composing-stick, and tying them up with packthread. Much of the work in the type foundry is performed by boys and females. In the preceding cut are represented a man casting types at a furnace, and a boy breaking off the jets; also two females rubbing types on a large grindstone. The fumes arising from melted lead in the casting-room are considered deleterious to health.

6. Various sizes of the same kind of letter are extensively used, of which the following are most employed in printing books—Pica, Small Pica, Long Primer, Bourgeois, Brevier, Minion, Nonpareil, Pearl, and Diamond. A full assortment of any particular size is called a *fount*, which may consist of any amount, from five pounds to five hundred, or more. The master type-founder usually supplies the printer with all the materials of his art, embracing not only types, leads, brass rules, and ordinary ornaments, but also cases, composing-stick, galleys, printing-presses, and other articles too numerous to be mentioned.

7. The inventor of the art of casting types was Peter Shœffer, first servant or workman employed by Guttemburg and Faust. He privately cut a matrix for each letter of the alphabet, and cast a quantity of the types. Having shown the products of his ingenuity to Faust, the latter was so much delighted with the contrivance, that he made him a partner in the printing business, and gave him his only daughter, Christina, in marriage.

8. The character first employed was a rude old gothic, mixed with secretary, designed on purpose to imitate the handwriting of those times, and the first used in England were of this kind. To these succeeded what is termed *old English*, or *black letter*, which is still occasionally applied to some purposes; but Roman letter is now the national character not only of England, but of France, Spain, Portugal, and Italy. In Germany, and in the States surrounding the Baltic, letters are used which owe their foundation to the gothic, although works are occasionally printed for the learned in Roman.

9. The Roman letter owes its origin to the nation whence it derives its name; although the faces of the present and ancient Roman letters differ materially, on account of the improvements which they have undergone at various times. For the invention of the Italic character, we are indebted to Aldus Manutius, who set up a printing-office in Venice in 1496, where he also introduced Roman types of a neater cut.

THE STEREOTYPER.

1. The word *stereotype* is derived from two Greek works—*stereos*, solid, and *tupos*, a type. It is applied to pages of types in a single piece, which have been cast in moulds formed on common printing types or wood cuts. They are composed of lead and antimony, in the proportion of about six parts of the former to one of the latter. Sometimes a little tin is added.

2. The types are *set up* by *compositors*, as usual in printing, and *imposed* or locked up, one or several pages together, in an iron *chase* of a suitable size. Having been sent to the *casting-room*, the types are slightly oiled, and surrounded with a frame of brass or type-metal. They are then covered with a thin mixture of finely pulverized plaster, and water. In about ten minutes, the plaster becomes hard enough to be removed.

3. The mould, thus formed, having been baked in an oven, is placed in an iron pan of an oblong shape, and sunk into a kettle of the melted composition above mentioned, which is admitted at the four corners of the cover to the cavities of the mould beneath. The pan is then raised from the kettle, and placed over water. When the metal has become cool, the contents of the pan are removed, and the plaster is broken and washed from the plate.

4. As fast as the pages are cast, they are sent to the *finishing-room*. Here they are first planed on the back with a machine, for the purpose of making them level and of an equal thickness. The let-

ters are then examined, and, when deficient, are rendered perfect by little steel instruments called *picks*. Corrections and alterations are made by cutting out original lines, and inserting common printing types, or lines stereotyped for the purpose. The types are cut off close to the back with pincers, and fastened to the place with solder. The plates, when they are finished, are about one-sixth of an inch in thickness.

5. When all the pages of a work have been completed, they are packed in boxes, which are marked with certain letters of the alphabet, to indicate the form or pages which they contain. While the pages are being applied in printing, they are fastened to blocks of solid wood, which, with the plates, are intended to be the same in height with common types.

6. The first stereotype plates were cast by J. Van der Mey, a Dutchman, who resided at Leyden about the year 1700. A quarto and folio Bible, and two or three small works, were printed from pages of his casting; but at his death, the art appears to have been lost, although the plates of these two Bibles are still extant, the former at Leyden, and the latter at Amsterdam.

7. In 1725, William Ged, of Edinburgh, without knowing what had been done in Holland by Van der Mey, began to make stereotype plates. But being unable to prosecute the business alone for want of funds, he united in partnership with three others. One of the partners being a type- nder, supposing that success in the rprise would injure his business, em- yed men to compose and print the pro- ed works in a manner that he thought to spoil them.

8. Accordingly, the compositors, while correcting one error in the proof, made intentionally several more; and the pressmen battered the letter, while printing the books. By these dishonest and malicious proceedings, the useful enterprise of Mr. Ged was defeated. He, however, afterwards printed, in an accurate manner, two or three works. The first of these was a Sallust, the pages of which were set up by his son, James Ged, who was but an apprentice to the printing-business. This part of the work was performed in the night, when the workmen were absent from the office.

9. After the death of Mr. Ged, no attention was paid to the art, and a knowledge of it was lost at the decease of his son, which took place about the year 1771; but it was a third time invented by Alexander Tilloch, Esq., who, in conjunction with Mr. Foulis, printer to the University of Glasgow, made many experiments, until plates were produced yielding impressions which could not be distinguished from those of the types from which they had been cast. But owing to circumstances unconnected with the real utility of the art, the business was not prosecuted to a great extent.

10. About the year 1804, the art was again revived by the late Earl Stanhope, assisted by Mr. A. Wilson, a printer, who turned his whole attention that way. In their efforts to complete the invention, they were assisted by Messrs. Tilloch and Foulis; and although they succeeded, after many experiments, they were strenuously opposed in their efforts to introduce the practice, the printers supposing, perhaps with some reason, that it would prove injurious to their business.

THE PAPER-MAKER, AND THE BOOKBINDER.

THE PAPER-MAKER.

1. The materials on which writing was executed, in the early days of the art, were the leaves and bark of trees and plants, stones, bricks, sheets of lead, copper, and brass, as well as plates of ivory, wooden tablets, and cotton and linen cloth.

2. The instruments with which writing was practised were adapted to the substance on which it was to be formed. The *stylus*, which the Romans employed in writing on metallic tablets covered with wax, was made of iron, acute at one end, for forming the letters, and flat or round at the other, for erasing what may have been erroneously written.

3. For writing with ink, the *calamus*, a kind of reed, sharpened at the point, and split like our pens, was used. Some of the eastern nations still write with bamboos and canes. The Chinese inscribe their characters with small brushes similar to camel's hair pencils. We have no certain evidence of the application of *quills* to this purpose until the seventh century.

4. As the literature of antiquity advanced, a material adapted to works of magnitude became necessary, and this was found both in the skins of animals, and in the celebrated plant papyrus, of Egypt; but the time when they were first applied to this purpose cannot be determined, although it is probable that the former has the preference as regards priority.

5. The papyrus was an aquatic plant, which grew upon the banks of the Nile. In the manufacture of paper from this reed it was divested of its outer covering, [illegible]

the stem, [illegible] layers of the plant were separated with the point of a needle or knife. These layers [illegible] each other on a [illegible] numbers to form a sheet; a second layer was then laid on the strips crossing those of the first at right angles; and the whole having been moistened with water, was subjected to pressure between metallic surfaces. The pressure, aided by a glutinous substance in the plant, caused the several layers to become one uniform sheet.

6. Parchment was manufactured from the skins of sheep and goats. In the preparation, these were first steeped in water impregnated with lime, and afterwards stretched upon frames, and reduced by scraping with sharp instruments. They were finished by the application of chalk, and by rubbing them with pumice-stone. The skins of very young calves, dressed in a similar manner, was called vellum. Parchment and vellum are still used for deeds and other important documents.

7. When Attalus, about 200 years before Christ, was about to found a library at Pergamus, which should rival that of Alexandria, one of the Ptolemies, then king of Egypt, jealous of his success, prohibited the exportation of papyrus; but the spirited inhabitants of Pergamus manufactured parchment as a substitute, and formed their library principally of manuscripts on this material. From this fact, it received the name of *Pergamena* among the Romans, who gave it also the appellation of Membr- [illegible]

8. The [illegible] tity of paper was [illegible] manuf [illegible] ia, and the com- [illegible] were [illegible] y increased the [illegible] und [illegible] fifth century, [illegible] by taxation; pa [illegible] lucement for [illegible] te. Accordingly, in the eighth century, it began to be superseded by cotton paper, although it continued in use in some parts of Europe until three hundred years after the period last mentioned.

9. The manufacture of cotton paper was introduced into Spain in the eleventh century by the Arabians, who became acquainted with it in Bucharia as early as A. D. 704. About the year 1300, it was commenced in Italy, France, and Germany; and in some of the paper-mills of these countries paper was first made from cotton rags. Proper linen paper is thought to have originated in Germany, about the year 1318.

10. The first paper-mill in England was erected by a German, named Spillman, in 1588; but no paper, except the coarse brown sorts, was made in that country until about the year 1690: the finer kinds, both for writing and printing, were, before that time, imported from the continent. But the paper of English manufacture will now compare with that of any other country. The French also make very fine paper.

11. In the United States, this manufacture has rapidly increased in amount within a few years. According to an estimate made in 1829, it appears that the whole annual product of the mills is worth between five and seven millions of dollars, and that the rags collected in this country amount to about two millions. The number of hands employed in the business is ten or eleven thousand, of whom about one-half are females.

12. Nature has supplied us with a great variety of substances from which paper may be fabricated, as flax, hemp, cotton, straw, grass, and the bark of several kinds of trees; but the fibres of the three first productions, in the form of rags, are the most usual materials. Most of these are

primarily purchased from the people at large, by retail booksellers, country merchants, and pedlars, who in turn dispose of them to persons called rag-merchants, or directly to the paper-makers. When the rags come from the original collectors, all kinds are mixed together, but they are assorted according to their colour and the nature of their original fibre, either by the rag-merchants, or by the paper-makers themselves.

13. In our attempts to afford the reader an idea of this manufacture in general, letter-paper has been selected, as affording the best means of illustration; since for this kind of paper, the best stock is employed, and the greatest skill is exerted in every stage of the process.

14. The process of the manufacture is commenced by cutting the rags into small pieces, by the aid of a sharp instrument, commonly a piece of a scythe, which is placed in a position nearly perpendicular before the operator. In the reduction of very coarse rags, such as sail-cloth, a cutting machine is also employed. Then, with the view of sifting out the loose particles of dirt, the rags are deposited in a large octagonal sieve made of coarse wire, and placed in a close box in a horizontal position. The sieve is moved by machinery, like the bolt of a flour-mill.

15. The second stage of the process consists chiefly in the reduction of the rags to a *pulp*. This is effected by the action of a cutting machine, the essential parts of which are two sets of blunt knives, the one stationary, and the other revolving. The machine is placed in a large elliptical tub, in which the rags are also deposited, with a suitable quantity of water. The liquid and fibrous contents of the tub are kept moving in a circle by the action of the machine, through which it passes at one point of its revolution.

16. The maceration occupies from ten to twenty hours, according as the material is more or less rigid; and, during part of this time, water is permitted to run in at one side of the tub, and out at the other, to render the pulp perfectly clean. Towards the close of this process, the pulp, if necessary, is bleached by means of chloride of lime, and oil of vitriol. It is also sometimes coloured by adding a quantity of dye stuff. The bleaching and colouring are effected without interrupting the action of the machine. The rags having been thus reduced, the pulp, together with a suitable quantity of water, is let out into a reservoir, from which it is drawn off into a *vat*, as fast as it may be needed for the production of paper.

17. With this vat is connected the paper-making machine; and the part of the latter which first comes in contact with the material is a hollow cylinder, surrounded with a fine web of wire-cloth. This cylinder being immersed in the contents of the vat more than one-half of its diameter, the water passes off with a uniform rapidity, and the fibrous particles which had been suspended in it, settle with remarkable uniformity on the outside of the brazen web. As the cylinder revolves, a continued sheet is produced, which is taken up by an endless web of woollen cloth, and carried round another cylinder of equal diameter, and then between two more, by which it is partially pressed.

18. From between these rollers, the paper passes out, in a continued sheet, upon a large cylindrical reel, called the *lay-boy;* and when a certain quantity of it, which is determined by a gauge, has been accumulated, the lay-boy is removed to a

table. The paper is then cut, with a toothless handsaw, into sheets twice the size of letter-paper. This part of the operation is very quickly performed, as a workman can cut up and pile in heaps, to be pressed, twenty reams in half that number of minutes, and attend to the machine at the same time.

19. After the paper has been successively pressed and handled by separating the sheets, two or three times, it is hung up on small poles in an airy room, to be dried; and having been again pressed, it is sized by holding a quantity of the sheets at a time in a thin solution of glue and alum, the former of which is prepared in the paper-mill for the purpose, from shreds and parings of raw hides. The paper is freed from superfluous portions of the size, by submitting it to the action of a press. It is again dried as before, and again pressed; after which, the several sheets are examined, and freed from lumps and other extraneous substances.

20. They are then severed in half with a cutting machine, and afterwards calendered, by passing the sheets successively between rollers; or they are pressed between smooth pasteboards. In the latter case, hot metallic plates are sometimes interposed between every few quires of the sheets. The paper, when treated in this way, is called hot-pressed. It is next counted off into half-quires, put up into reams, pressed, trimmed, and finally enveloped in two thick sheets of paper, which completes the whole process of the manufacture.

21. The manufacture of paper, as just described, seems to be a tedious process; yet with two machines and a suitable number of hands, say sixty or eighty, three hundred reams of letter-paper can be produced from the raw material in a single day. It is hardly necessary to remark, that paper is of various qualities, from the finest bank-note paper, down to the coarsest kinds employed in wrapping up merchandise; and that, for every quality, suitable materials are chosen: the process of the manufacture is varied, of course, to suit the materials. None but writing and drawing paper requires to be sized.

22. Until after the beginning of the present century, paper was made exclusively *by hand*, and this method is still continued in a majority of the mills in the United States, although it is rapidly going out of use. It differs from that just described chiefly in the manner of collecting the pulp to form the paper, this being effected by means of a *mould*, a frame of wood with a fine wire bottom, of the size of the proposed sheet. In the use of this instrument, a quantity of the pulp is taken up, and while the *vatman*, or *dipper*, holds it in a horizontal position, and gives it a gentle shaking, the water runs out through the interstices of the wire, and leaves the fibrous particles upon the mould in the form of a sheet. The sheets thus produced are pressed between felts, and afterwards treated as if they had been formed by means of a machine.

23. The first idea of forming paper in a continued sheet originated in France; but a machine for this purpose is said to have been first made completely successful in England, by Henry and Sealy Fourdrinier. Many machines made after their model, as well as those of a different construction, are in use in the United States; to some of which is attached an apparatus for drying and pressing the paper before it is wound upon the lay-boy. Very few machines, however, yield paper equal in firmness and tenacity to that produced by hand.

THE BOOKBINDER.

1. **Bookbinding** is the art of arranging the pages of a book in proper order, and confining them there by means of thread, glue, paste, pasteboard, and leather.

2. This art is probably as ancient as that of writing books; for, whatever may have been the substance on which the work was executed, some method of uniting the parts was absolutely necessary. The earliest method with which we are acquainted, is that of gluing the sheets together, and rolling them upon small cylinders. This mode is still practised in some countries. It is also everywhere used by the Jews, so far as relates to one copy of their law deposited in each of their synagogues.

3. The name Egyptian is applied to this kind of binding, and this would seem to indicate the place of its origin. Each volume had two rollers, so that the continued sheet could be wound from one to the other at pleasure. The square, or present form of binding, is also of great antiquity, as it is supposed to have been invented at Pergamus, about 200 years before Christ, by king Attalus, who, with his son Eumenes, established the famous library in that city.

4. The first process of binding books consists in folding the sheets according to the paging. This is done by the aid of an ivory knife called a *folder*, and the operator is guided in the correct performance of the work by certain letters called *signatures*, placed at the bottom of the page, at regular intervals through the book.

5. Piles of the folded sheets are then placed on a long table in the order of their signatures, and gathered, one from each pile, for every book. They are next beaten on a stone, or passed between steel rollers, to render them smooth and solid. The latter method has been introduced within a few years. This operation certainly increases the intrinsic value of the book; but it is not employed in every case, since it is attended with some additional expense, and since it diminishes the thickness of the book, and consequently its value in the estimation of the public at large.

6. The sheets, having been properly pressed, are next sewed together upon little cords, which, in this application, are called bands. During the operation, these are stretched in a perpendicular direction, at suitable distances from each other, as exhibited in the foregoing cut. The folded sheets are usually notched on the back by means of a saw, and at these points they are brought in juxta-position with the bands. After the pages of several volumes have been accumulated, the bands are severed between each book. The folding, gathering, and sewing, are usually performed by females.

7. At this stage of the process, the books are received by the men or boys, who generally *take on* one hundred at a time. The workman first spreads some glue on the back of each book with a brush. He then places them, one after the other, between boards of solid wood, and beats them on the back with a hammer. By this means the back is rounded, and a groove formed on each side for the admission of one edge of the pasteboards.

8. These having been applied, and partially fastened by means of the bands, which had been left long for the purpose, the books are pressed, and the leaves of which they are composed are trimmed with an instrument called a ***plough***. The pasteboards are also cut to the proper size by the same means, or with a huge pair of shears. In the preceding picture, a workman is represented at work with the

plough. The edges are next sprinkled with some kind of colouring matter, or covered with gold leaf. A strip of paper is then glued on the back, and a *head-band* put upon each end.

9. The book is now ready to be covered. This is either done with calf, sheep, or goat skin, or some kind of paper or cloth; but whatever the material may be, it is cut into pieces to suit the size of the book; and, having been smeared on one side with paste, it is drawn over the outsides of the pasteboards, and doubled in upon the inside.

10. The covers, if calf or sheep skin, are next sprinkled or marbled. The first operation is performed by dipping the brush in a kind of dye, made for the purpose, and beating it with one hand over a stick held in the other; the second is performed in the same manner, with the difference that they are sprinkled first with water, and then with the colouring matter.

11. After a small piece of morocco has been pasted on the back, on which the title is to be printed in gold leaf, and one of the waste leaves has been pasted down on the inside of each of the covers, the books are pressed for the last time. They are then glazed by applying the white of an egg with a sponge.

12. The books are now ready for the reception of the ornaments, which consist chiefly of letters and other figures in gold leaf. In executing this part of the process, the workman cuts the gold into suitable strips or squares, on a cushion.

13. These are laid upon the books by means of a piece of raw cotton, and afterwards impressed with types moderately heated over a charcoal fire; or the strips of gold are taken up, and laid upon the proper place with instruments called *stamps* and *rolls*, which have on them figures in relief. The portion of the leaf not impressed with the figures on the tools, is easily removed with a silk rag. The books are finished by applying to the covers the white of an egg, and rubbing them with a heated steel *polisher*.

14. The process of binding books, as just described, is varied, of course, in some particulars, to suit the different kinds of binding and finish. A book stitched together like a common almanac is called a pamphlet. Those which are covered on the back and sides with leather, are said to be *full-bound;* and those which have their backs covered with leather, and the sides with paper, *half-bound.*

15. The different sizes of books are expressed by terms indicative of the number of pages printed on one side of a sheet of paper: thus, when two pages are printed on one side, the book is termed a folio; four pages, a quarto; eight pages, an octavo; twelve pages, a duodecimo; eighteen pages, an octodecimo. All of these terms, except the first, are abridged by prefixing a figure or figures to the last syllable: thus, 4to. for quarto, 8vo. for octavo, 12mo. for duodecimo, &c.

16. The manufacture of account-books, and other blank or *stationary* work, constitutes an extensive branch of the bookbinder's business. It is not necessary, however, to be particular in noticing it, as the general process is similar to that of common bookbinding. Those binders who devote much attention to this branch of the trade, have a machine by which paper is ruled to suit any method of keeping books, or any other pattern which may be desired.

THE BOOKSELLER.

1. The book trade has arisen from small beginnings to its present magnitude and importance. Before the invention of typography, it was carried on by the aid of transcribers; and the booksellers of Greece, Rome, and Alexandria, during the flourishing state of their literature, kept a large number of manuscript copyists in constant employ. Among the Romans, the transcribers or copyists were chiefly slaves, who were very valuable to their owners, on account of their capacity for this employment.

2. In the middle ages, when learning was chiefly confined to the precincts of monastic institutions, the monks employed much of their time in copying the ancient classics and other works; and this labour was often imposed upon them as a penance for the commission of sin. From this cause, and from an ignorance of the true meaning of the author, much of their copying was inaccurately performed, so that great pains have been since required in the correction of the manuscripts of those times.

3. This mode of multiplying copies of books was exceedingly slow, and, withal, so very expensive, that learning was confined almost exclusively to people of rank, and the lower orders were only rescued from total ignorance by the reflected light of their superiors. For a long time, during the reign of comparative barbarism in Europe, books were so scarce, that a present of a single copy to a religious house was thought to be so valuable a gift, that it entitled the donor to the prayers of the community, which were considered effica-

cious in procuring for him eternal salvation.

4. After the establishment of the universities of Paris and Bologna, there were dealers in books, called *stationarii*, who loaned single manuscripts at high prices; and, in the former place, no person, after the year 1432, could deal in books in any way, without permission from the university, by which officers were appointed to examine the manuscripts, and fix the price for which they might be sold or hired out.

5. For a long time after the invention of printing, the printers sold their own publications; and in doing this, especially at some distance from their establishments, they were aided by those who had formerly been employed as copyists. Some of these travelling agents at length became stationary, and procured the publication of works on their own account.

6. The first bookseller who purchased manuscripts from the authors, and caused them to be printed without owning a press himself, was John Otto, of Nuremburg. He commenced this mode of doing business in 1516. In 1545, there were, for the first time, two such booksellers in Leipsic. The great mart for the sale of their books was Frankfort on the Maine, where were held three extensive fairs every year. Leipsic, however, soon became, and still continues, the centre of the
an book trade.

he first Leipsic catalogue of books
d as early as the year 1600; but
at that place did not become im-
, as regards the book trade, until
when it was attended by nineteen
booksellers. The booksellers of
as some from distant
he semi-annual fairs
pose of books, and
with each other. Every German publisher has also an agent there, who receives his publications, and sends them, according as they are ordered, to any part of Germany.

8. In no other part of the world, has such a connexion of booksellers been formed, although almost every kingdom of Europe has some city or cities in which this branch of trade is chiefly concentrated; as London, in England; Edinburgh, in Scotland; and Amsterdam, Utrecht, Leyden, and Haerlem, in the Netherlands. In Spain and Portugal, the price of every book is regulated by the government.

9. A very convenient method of effecting the sale and exchange of books among booksellers, has been adopted in the United States; and this is by auction. A sale of this kind is held in Boston once, and in New-York and Philadelphia twice, every year; and none are invited to attend it but the *trade;* hence such sales are denominated *trade sales.*

10. The sale is usually conducted by an auctioneer who has been selected by a committee of the trade in the city in which it is to be held. In order to obtain a sufficient amount of stock for the purpose, the agent issues proposals, in which he informs publishers and others concerned in this branch of business, of his intention, and solicits invoices of books, to be sold at the time specified. A catalogue of all the books thus sent for sale, is printed and distributed among the booksellers.

11. The booksellers having assembled, the books which may have been accumulated from different parts of the Union are offered in convenient lots, and *struck off* to the highest bidder. Each purchaser holds in his hand the printed catalogue, on the broad margin of which he marks,

if he see fit, the prices at which the books have been sold; and the record thus kept affords a tolerable means of determining their value, for a considerable time afterwards.

12. A sale of this kind occupies from two to four days; and, at the close of it, a settlement takes place, in which the parties are governed by the terms previously published. The payments are made in cash or by notes at four or six months, according to the amount which the purchaser may have bought out of one invoice. The conductors of the sale are allowed between four and five per cent. commission for their services.

13. A vast number of books is also sold, every year, at auction, to miscellaneous collections of people, not only in the cities and considerable towns, but likewise in the villages throughout the country. By many booksellers, this method of sale is thought to be injurious to the trade, since it has reduced the prices of books, and interfered with the regular method of doing business. These disadvantages, however, have been far overbalanced by the increased number of readers which has been thus created.

14. The circulation of books is likewise promoted by means of travelling agents, who either sell them at once, or obtain subscriptions for them with the view to their future delivery. These methods have been employed more or less from the very commencement of the printing business; and they have probably contributed more to the general extension of knowledge than the sale of books by stationary booksellers. In fact, they are among the most prominent causes of the vast trade in books, which is now carried on, especially in the United States.

15. Nevertheless, publishers, who do not employ agents to vend their books, generally consider them interlopers upon their business; and the people themselves who owe a great share of their intellectual cultivation to this useful class of men, are generally averse to afford them the necessary patronage, because they require a small advance on the city prices to pay travelling expences.

16. A considerable amount of books is also sold by merchants who reside at some distance from the cities and large towns. They, however, seldom venture to purchase those which have not been well known and approved in their neighbourhood; and, in a majority of cases, regard them as mere subjects of merchandise, without taking into consideration the effects most likely to be produced by these silent, but powerful agents, when circulated among their customers.

17. Some booksellers in Europe confine their trade chiefly to particular departments; such as law, theology, and medicine. Others deal in toy-books, and books of education, or in rare and scarce books. This is the case, to a limited extent, in the United States, although our booksellers commonly keep an assortment of miscellaneous publications, as well as various articles in the stationary line—such as paper, quills, inkstands, and blank work.

THE ARCHITECT.

1. ARCHITECTURE, in the general sense of the word, is the planning and erecting buildings of all kinds, whether of a public or private nature; and it embraces within its operations a variety of employments, at the head of which must be placed the Architect. Architecture is of several kinds, such as *civil*, *naval*, *military*, and *aquatic*; but it is the first only that we propose to notice in the present article.

2. The construction of buildings as means of shelter from the weather, appears to have been among the earliest inventions; and, from the skill exhibited in the construction of the ark, we have reason to believe that architecture had been brought to [illegible]derable perfection before the d[illegible] opinion is also supported by the fact stated in holy writ, that the descendants of Noah, not more than one hundred years after the great catastrophe just mentioned, attempted to build a city and a lofty tower with bricks burned in the fire. This project could never have been thought of, had they not been influenced by the knowledge of former centuries.

3. The confusion of the language of the people caused their dispersion into different parts of the earth; and, in their several locations, they adopted that method of constructing their dwellings, which the climate required, and the materials at hand admitted; but, whatever the primitive structure may have been, it was continued, in its general features, from age to age, by the more refined and opulent

inhabitants; hence the different styles of building, which have been continued, with various modifications, to the present day.

4. The essential elementary parts of a building are those which contribute to its support, inclosure, and covering; and of these the most important are the foundation, the column, the wall, the lintel, the arch, the vault, the dome, and the roof. Ornamental and refined architecture is one of the fine arts; nevertheless, every part of an edifice must appear to have utility for its object, and show the purpose for which it has been designed.

5. The *foundation* is usually a stone wall, on which the superstructure of the building rests. The most solid basis on which it is placed is rock, or gravel which has never been disturbed; next to these are clay and sand. In loose or muddy situations, it is always unsafe to build, unless a solid basis can be artificially produced. This is often done by means of timber placed in a horizontal position, or by driving wooden piles perpendicularly into the earth; on a foundation of the latter description, the greater part of the city of Amsterdam has been built.

6. The *column*, or *pillar*, is the simplest member of a building, although it is not essential to all. It is not employed for the purpose of inclosure, but as a support to some part of the superstructure, and the principal force which it has to resist is that of perpendicular pressure. The column is more frequently employed in public than in private buildings.

7. The *wall* may be considered the lateral continuation of the column, answering the purposes both of support and inclosure. It is constructed of various materials, but chiefly of brick, stone, and marble, with a suitable proportion of mortar or cement. Walls are also made of wood, by first erecting a frame of timber and then covering it with boards: but these are more perishable materials, which require to be defended from the decomposing influence of the atmosphere, by paint, or some other substance.

8. The *lintel* is a beam extending in a right line from one column or wall to another over a vacant space. The *floor* is a lateral continuation or connexion of beams, by means of a covering of planks. The strength of the lintel, and, in fact, every other elementary part of a building used as a support, can be mathematically determined by the skilful architect.

9. The *arch* answers the same purpose as the lintel, although it far exceeds it in strength. It is composed of several pieces of a wedge-like form, and the joints formed by the contact of thin surfaces point to a common centre. While the arch is being constructed, the materials are supported by a *centring* of the shape of its internal surface. The upper stone of an arch is called the *key-stone*. The supports of an arch are called *abutments;* and a continuation of arches, an *arcade*.

10. The *vault* is the lateral continuation of an arch, and bears the same relation to it that a wall does to a column. The construction of a simple vault is the same with that of an arch, and it distributes its pressure equally along the walls or abutments. A complex or groined vault is made by the intersection of two of the common kind. The groined vault is much used in Gothic architecture.

11. The *dome*, or *cupola*, is a hemispherical or concave covering to a building or a part of it. When built of stone it is a very strong kind of structure, even more so than the arch, since the tendency

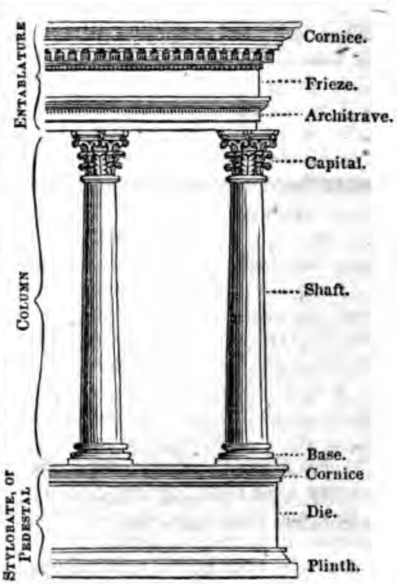
of the parts to fall is counteracted by those above and below, as well as by those on each side. During the erection of the cupola, no centring is required, as in the case of the arch.

12. The *roof* is the most common and cheap covering to buildings. It is sometimes flat, but most commonly oblique, in shape. A roof consisting of two oblique sides meeting at the top, is denominated a *pent* roof; that with four oblique sides, a *hipped* roof; and that with two sides, having each two inclinations of different obliquities, a *curb* or *mansard* roof. In modern times, roofs are constructed of wood, or of wood covered with some incombustible material, such as tiles, slate, and sheets of lead, tin, or copper. The elementary parts of buildings, as just described, are more or less applicable in almost every kind of architecture.

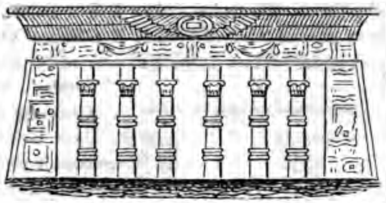
13. The architecture of different countries has been characterized by peculiarities of form and construction, which, among ancient nations, were so distinct, that their edifices may be identified at the present day even in a state of ruin; and, although nearly all the buildings of antiquity are in a dilapidated state, many of them have been restored, in drawings and models, by the aid of the fragments which remain.

14. The different styles of building which have been recognized by the architect of modern times, are, the Egyptian, the Chinese, the Grecian, the Roman, the Greco-Gothic, the Saracenic, and the Gothic. In all these, the pillar, with its accompaniments, makes a distinguished figure. The following picture has therefore been introduced by way of explanation. The columns are of the Corinthian order

tecture.



15. The *Egyptian style.*—The first inhabitants of Egypt lived in mounds, caverns, and houses of mud; and from these primitive structures, the Egyptians, at a later period, derived their style of architecture. The walls of their buildings were very thick, and sloping on the outside; the roof was flat, and composed of blocks of stone, extending from one wall or pillar to another; and the columns were short and large, being sometimes ten or twelve feet in diameter. Pyramids of prodigious magnitude, and obelisks composed of a single stone, sometimes often exceeding seventy feet in height, are structures peculiarly Egyptian. The architecture of the Hindoos seems to have been derived from primitive structures of a similar character.



AN EGYPTIAN TEMPLE.

16. *The Chinese style.* The ancient Tartars, and other wandering tribes of Asia, appear to have lived in tents; and the Chinese buildings, even at the present day, bear a strong resemblance to these original habitations, since their roofs are concave on the upper side, as if made of canvas instead of wood. Their porticoes resemble the awnings spread out on our shop-windows in the summer. The Chinese build chiefly of wood, although they sometimes use brick and stone.

A CHINESE PAGODA.

17. *The Grecian style.* This style of building had its origin in the wooden hut or cabin, the frame of which primarily consisted of perpendicular posts, transverse beams, and rafters. This structure was at length imitated in stone, and by degrees it was so modified and decorated in certain parts, as to give rise to the several distinctions called orders of architecture. The Greeks, in perfecting their system of architecture, were probably aided by Egyptian examples, although they finally surpassed all other nations in this important art.

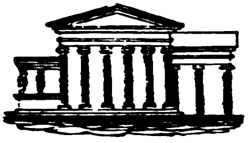
18. *Orders of architecture.* By the architectural orders are understood certain modes of proportioning and decorating the column and entablature. They were in use during the best days of Greece and Rome, for a period of six or seven centuries. The Greeks had three orders, called the *Doric*, the *Ionic*, and the *Corinthian.* These were adopted and modified by the Romans, who also added two others, called the *Tuscan* and the *Composite.*

19. *Doric order.* The Doric is the oldest and most massive order of the Greeks. The column, in the examples at Athens, is about six of its diameters in height: in those of an earlier date, it is but four or five. The temple here adduced to illustrate this order was built by Cimon, son of Miltiades, about the year 450 before Christ. It is said to be in a state of better preservation than any other of the ancient Greek edifices at Athens. It will be seen that the shafts are *fluted*, that is, cut in semicircular channels, in a longitudinal direction. The United States' Bank, at Philadelphia, is a noble specimen of this order.

THE TEMPLE OF THESEUS.

20 *Ionic order.* This order is lighter than the Doric, its column being eight or nine diameters in height. Its shaft has twenty-four or more flutings, separated from each other by square edges; and its capi-

tal consists, in part, of two double scrolls, called *volutes*, usually occupying opposite sides. These volutes are supposed to have been copied from ringlets of hair, or from the horns of the god Jupiter Ammon. The following example of this order consists of three temples, each of which was dedicated to a different individual, viz. Erectheus, Minerva Polias, and the nymph Pandrosus.



THE ERECTHEUM AT ATHENS.

21. *Corinthian order.* The Corinthian is the lightest and most decorated of all the Grecian orders. Its column is usually ten diameters in height, and its shaft is fluted like that of the Ionic. Its capital is shaped like an inverted bell, and was covered on the outside with two rows of the leaves of the plant acanthus, above which are eight pairs of small volutes. It is said that this beautiful capital was suggested to the sculptor Callimachus by the growth of an acanthus about a basket, which had been accidentally left in a garden.

22. The Greeks sometimes departed so far from the strict use of their orders, as to employ the statues of slaves, heroes, and gods, in the place of columns. A specimen of this practice is exhibited in the cut illustrative of the Ionic order. It belongs to the temple dedicated to Pandrosus.

23. The most remarkable buildings of the Gree [illegible] r temples. The body of the [illegible] of a walled cell, and [illegible] more rows of pillars. Sometimes they had a colonnade at one end only, and sometimes at both ends. Their form was generally oblong, and as the cells were intended as places of resort for the priests rather than for assemblies of the people, they were but imperfectly lighted. Windows were seldom employed; and light was admitted at the door at one end, or through an opening in the roof.

24. Grecian architecture is supposed to have been at its greatest perfection in the days of Pericles and Phidias, when sculpture is admitted to have attained its highest excellence. It was distinguished, in general, by simplicity of structure, fewness of parts, absence of arches, and lowness of pediments and roofs.

25. *Roman style.* The Romans adopted the three Grecian orders, with some modifications; and also added two others, called the Tuscan and Composite. The former of these they borrowed from the nation whose name it bears, and the latter they formed by uniting the embellishments of the Doric and the Corinthian. The favourite order in Rome and its colonies was the Corinthian. Examples of single pillars of these orders may be seen at the end of this article.

26. The temples of the Romans generally bore a strong resemblance to those of the Greeks, although they often differed from the specimens of that nation in several particulars. The stylobate of the latter was usually a succession of platforms, which likewise served the purposes of steps, by which the building was approached on all sides. Among the Romans, it was usually an elevated structure, like a continued pedestal on three sides, and accessible in front by means of steps. The dome was also very commonly employed

rather than the pent roof. The following is an example of a temple at Rome.

TEMPLE OF ANTONIUS AND FAUSTINA.

27. *Greco-Gothic style.* After the dismemberment of the Roman Empire, the practice of erecting new buildings from the fragments of old ones became prevalent. This gave rise to an irregular style of building, which continued in use during the dark ages. It consisted of Greek and Roman details combined under new forms, and piled up into structures wholly unlike the original buildings from which the materials had been taken. Hence the appellations *Greco-Gothic* and *Romanesque* have been applied to it. The effect of this style of building was very imposing, especially when columns and arches were piled upon each other to a great height.

28. *Saracenic style.* This appellation has been given to the style of building practised by the Moors and Saracens in Spain, Egypt, and Turkey. It is distinguished, among other things, by an elliptical form of the arch. A similar peculiarity exists in the domes of the oriental mosques, which are sometimes large segments of a sphere, appearing as if inflated; and at other times, they are concavo-convex on the outside. Several of these domes are commonly placed upon one building. The *Minaret* is a tall slender tower, peculiar to Turkish architecture.

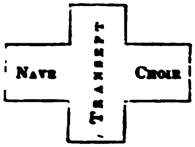
29. *Gothic style.* The Goths, who overran a great part of the Western Empire, were not the inventors of the style of architecture which bears their name. The term was first applied with the view to stigmatize the edifices of the middle ages; in the construction of which, the purity of the antique models had not been regarded. The term was at first very extensive in its application; but it is now confined chiefly to the style of building used in the construction of cathedrals, churches, abbeys, and similar edifices, which was introduced into various parts of Europe six or eight centuries ago.

GOTHIC CATHEDRAL AT YORK

30. The Gothic style is peculiarly and strongly marked. Its principles seem to have originated in the imitation of groves and bowers, under which the Druid priests had been accustomed to perform their sacred rites. Its characteristics are, its pointed arches, its pinnacles and spires, its large buttresses, clustered pillars, vaulted roofs, and a general predominance of the perpendicular over the horizontal.

31. The ecclesiastical edifices of this style of building are commonly in form of a cross, having a tower, lantern, or spire, erected at the point of intersection. The part of the cross situated towards the west is called the *nave;* the eastern part, the *choir;* and the transverse portion, the

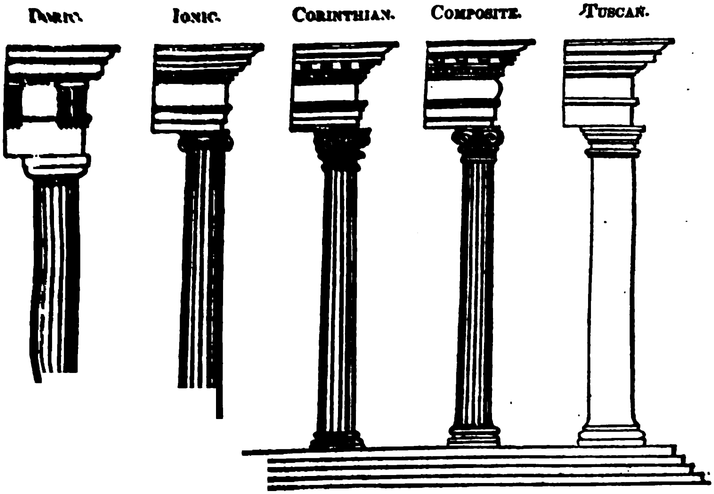
transept. A glance at the following diagram will enable the reader to understand the form of the ground-work more fully.



32. Any high building erected above a roof is called a *steeple*, which, however, is distinguished by different appellations, according to its form: if it be square topped, it is a *tower*; if long and acute, a *spire*; or if short and light, a *lantern*. Towers of great height in proportion to their diameter are denominated *turrets*. The walls of Gothic churches are supported on the outside by lateral projections, called *buttresses*, which extend from the bottom to the top, at the corners and between the windows. On the top of these are slender pyramidal structures or spires, called *pinnacles*. The summit or upper edge of a wall, if straight, is called a *parapet*; if indented, a *battlement*.

33. Gothic pillars or columns are usually clustered, appearing as if a number were bound together. They are confined chiefly to the inside of buildings, and are generally employed in sustaining the vaults which support the roof. The parts which are thrown out of a perpendicular to assist in forming these vaults, have received the appellation of *pendentives*. The Gothic style of building is more imposing than the Grecian; but architects of the present day find it difficult to accomplish what was achieved by the builders of the middle ages.

34. In the erection of edifices at the present day, the Grecian and Gothic styles are chiefly employed, to the exclusion of the others, especially in Europe and America. Modern dwelling-houses have necessarily a style of their own, so far as relates to stories, windows, and chimneys; and no more of the styles of former ages can be applied to them, than what relates to the unessential and decorative parts.



THE CARPENTER.

1. It is the business of the carpenter to cut out and frame large pieces of timber, and then to join them together, or fit them to brick or stone walls, to constitute them the outlines or skeleton of buildings or parts of buildings.

2. The joiner executes the more minute parts of the wood-work of edifices, comprehending, among other things, the floors, window-frames, sashes, doors, mantles, &c. Carpentry and joinery, however, are so nearly allied to each other, that they are commonly practised by the same individuals; and, in this article, they will be treated together.

3. Carpentry and joinery, as well as all other trades connected with building, are subservient to the architect, when an individual of this particular profession has been employed; but it most commonly happens, that the master-carpenter acts in this capacity. This is especially the case in the erection of common dwellings, and, in fact, of other edifices where nothing very splendid is to be attempted. It is to be regretted, however, that the professional architect has not been oftener employed; for, had this been the case, a purer taste in building would have generally prevailed.

4. Contracts for the erection of buildings are often made with the carpenter, as master-builder or architect. In such cases, it is his business to employ persons capable of executing every kind of work required on the proposed edifice, from the bricklayer and stone-mason to the painter and glazier. It not unfrequently happens,

4. The blocks of stone, received in their rough state by the stone-cutter, are divided, if required, into pieces of smaller size, by means of a toothless saw, aided by the attrition of sand and water. The other rough sides of the blocks are reduced to the proper form by means of steel *points* and *chisels* driven with a mallet. A kind of hammer with a point or chisel-like edge, is also used to effect the same object, especially in the softer kinds of stone.

5. For some purposes, the stones are required to be polished. This is especially the case with those employed in the ornamental parts of buildings. In the execution of this part of the work, the surface is rubbed successively with sand, free-stone, pumice-stone, Scotch stone, crocus, and putty. When the face is a plane, the sand is applied by means of another stone, which is moved backwards and forwards upon it. In this way, two surfaces are polished at the same time.

6. The different kinds of stone are used not in a pulverized state, but in masses of convenient size; and the part applied to the surface to be polished is first brought to a form corresponding to it. The putty is an oxide of tin in form of powder. Crocus is the peroxide of iron. The building-stone capable of receiving the highest polish is marble; and it is on this material that the stone-cutter, and the architectural carver or sculptor, exert their utmost skill; but some of the other stones which have been mentioned, possess the same quality to a considerable extent.

7. Carving architectural ornaments, and columns with their capitals, is a re- [illegible] this business; or rather it [illegible] branch of sculpture [illegible] of this kind of work, the operator is guided by patterns, formed from the well-defined rules of the science of building. Very few stone-cutters attempt the execution of work so very difficult.

8. From the manufacture of mantel-pieces and monuments for the dead, the stone-cutter derives a great proportion of his profits. This will be manifest even to the superficial observer who may visit a few of the many stone-cutters' yards, to be found in any of our large cities. In some of these, blocks of marble are cut into slabs by the aid of steam-power.

9. In districts of country, also, where valuable stone is abundant, water is extensively employed for the same purpose. This is especially the case in Berkshire county, Massachusetts, where marble of a good quality is abundant. A great proportion of the marble slabs used by the stone-cutter are obtained from such mills. Some other operations of this business are also sometimes performed by the aid of machinery.

THE STONE-MASON.

1. In Philadelphia, and in many other cities not only in this country but also in Europe, the stone-cutters *set their own work;* and this practice has led to the habit of applying the term stone-mason to both stone-cutters and those who lay stone in mortar and cement. In New-York, however, as well as in some of the cities farther east, these two employments are kept more distinct. The stone-cutters in Philadelphia are sometimes denominated marble-masons.

2. But in every city, there are persons called stone-masons, whose business consists exclusively in constructing the walls and some other parts of buildings with

stone; and their operations are considerably enlarged in those places where there are no marble-masons. In many cases, the bricklayer is also so far a stone-mason, as to lay the foundation-walls of the buildings which he may erect. This is especially the case in the country, where the divisions of labour are not so minute as in cities. It may be well to remark, also, that the bricklayers, in some places, perform the services of the marble-mason.

3. The marble-mason, in joining together several pieces in a monument, employs a kind of cement composed of about six parts of lime, one of pure sand, a little plaster, and as much water as may be necessary to form it to the proper consistency. No more of this cement is used than is required to hold the blocks or parts together; as one great object of the artist is to hide the joints as much as possible. The substance thus interposed becomes as hard as the marble itself.

4. The cement employed in laying marble, in common or large edifices, is somewhat different from that just described, as it consists of about three fourths of lime and one of sand. The latter substance is obtained, in an unmixed state, on the bays in every part of the world; hence it has received the appellation of *bay sand.*

5. When it cannot be conveniently had in a pure state, particles of the same kind can be separated in sufficient quantities from their admixture with other substances. This is effected by sifting the compound through a sieve, into a small stream of water, which carries off the lighter particles that are unfit for use, whilst the sand, by its superior specific gravity, sinks to the bottom. The part which may be too coarse, remains in the sieve. This, however, except the rubbish, can be used in the coarser kinds of masonry.

6. The mortar, used in laying bricks and common stone, has a greater proportion of sand, which is generally of an inferior quality. Besides, the materials are incorporated with less care. Lime for the purposes of building is procured chiefly by calcining limestone in a kiln, with wood, coal, or some other combustible substance. It is also obtained by burning chalk, marble, and marine shells. Water poured upon newly-burnt or *quick* lime, causes it to swell, and fall to pieces into a fine powder. In this state it is said to be *slacked.*

7. Masonry is often required in situations under water, especially in the construction of bridges and locks of canals. Common mortar resists the action of the water very well, when it has become perfectly dry; yet, if it is immersed before it has had time to harden, it dissolves, and crumbles away.

8. The ancient Romans, who practised building in the water to a great extent, discovered a material, which, when incorporated with lime, either with or without sand, possessed the property of hardening in a few minutes even under water. This was a kind of earth found at Puteoli, to which was given the name of *pulvis puteolanus,* and which is the same now called *puzzolana.*

9. A substance denominated *tarras, terras,* or *tras,* found near Andernach, in the vicinity of the Rhine, possesses the same quality with puzzolana. It is this material which has been principally employed by the Dutch, whose aquatic structures are superior to those of any other nation in Europe. Various other substances, such as baked clay and calcined green stone, reduced to powder, afford a tolerable material for water cements.

10. In the construction of buildings with marble and other costly stones, the

walls are not composed of these materials in their entire thickness; but, for the sake of cheapness, they are formed on the inside with bricks, commonly of a poor quality, so that in reality they can be considered only brick walls faced with stone. These two kinds of materials have no other connexion than what is produced by the mortar which may have been interposed, and the occasional use of clamps of iron. Such walls are said to be liable to become convex outwardly from the difference in the shrinking of the cement employed in laying the two walls.

11. The principal tools employed in cutting and laying stone are the saw, various kinds of steel points, chisels, and hammers, the mallet, the square, the compasses, the level, the plumb-rule, the trowel, and the hod; to which may be added, the spade and the hoe. The last three instruments, however, are handled almost exclusively by labourers.

12. Besides these, contrivances are required to raise heavy materials to the various positions which they are to occupy. These consist, for the most part, of one or two shafts, commonly the mast of an old vessel, to which are attached tackle extending in various directions, and also those by which the blocks are to be raised. The rope belonging to the hoisting tackle is pulled by a machine worked with a crank.

13. Masonry is one of the primitive arts, and was carried to great perfection in ancient times. The pyramids of Egypt are supposed to have stood about three thousand years, and they will probably remain [illegible] to [illegible] monuments as well of the skill, as of the power and industry [illegible] and other magnificent [illegible] and Rome, ex- [illegible] masonry, and leave but little if anything new to be achieved in modern times.

THE BRICKMAKER.

1. Brick is a sort of artificial stone made principally of argillaceous earths formed in moulds, dried in the sun, and burned with fire.

2. The earliest historical notice of bricks is found in the book of Genesis, where it is stated that the posterity of Noah undertook to build a city and a lofty tower of this material. Whether the bricks were really exposed to the action of fire, as the passage referred to seems to imply, or only dried in the sun, is an unsettled point. But Herodotus, who visited the spot many centuries afterwards, states that the bricks in the tower of Babylon were baked in furnaces.

3. It is evident, however, that the earliest bricks were commonly hardened in the sun; and, to give them the requisite degree of tenacity, chopped straw was mixed with the clay. The manufacture of such bricks was one of the tasks imposed upon the Israelites, during their servitude with the Egyptians.

4. The extreme dryness and heat of the climate in some of the eastern countries, rendered the application of fire dispensable; and there are structures of unburnt bricks still remaining, which were built two or three thousand years ago. Bricks both sun-dried and burned, were used by the Greeks and the Romans.

5. The walls of Babylon, some of the ancient structures of Egypt and Persia, the walls of Athens, the rotunda of the Pantheon, the temple of Peace, and the Thermæ, or baths, at Rome, were all built of brick. The most common bricks among the Romans were seventeen inches

long and eleven broad; a size, certainly, far preferable, as regards appearance, to those of modern manufacture.

6. In the United States, a great proportion of the edifices, particularly in the cities and towns, are constructed of bricks which are usually manufactured in the vicinity of the place where they are to be used. The common clay, of which they are made, consists of a mixture of argillaceous earth and sand with a little oxyde of iron, which causes them to turn red in burning. The material for bricks is dug up, and thrown into a large heap, late in the fall or in the winter, and exposed to the influence of the frost until spring.

7. The operation of making bricks is conducted very systematically; and, although every part of the work seems to be very simple, it requires considerable dexterity to perform it properly and to the best advantage. The workmen in the yards about Philadelphia are divided into *gangs* consisting of three men and a boy. The first is called the *temperer*, who tempers the material with water and mixes it with a spade; the second is called the *wheeler*, who conveys it on a barrow to a table, where it is formed in moulds by the *moulder*, and carried thence to the *floor* by the boy, who is denominated the *off-bearer*.

8. The bricks are suffered to remain on the floor a day or two, or until they have become dry enough to be handled with safety. They are then removed and piled into a *hack*, under cover, in such a manner that the air may circulate freely between them. It is the business of the whole gang to remove the bricks from the floor, and also to place them in the kiln to be burned. In both cases, each one has his due proportion of labour to be performed.

9. The day's work of a gang, when the weather is favourable, is to make and pile in the hack a tale of bricks, which consists of 2332, or an even 2000. The former number is called a *long tale*, and the latter, a *short tale*. Considerable skill and much care are required in burning the bricks in a proper manner; too much fire would cause them to vitrify, and too little would leave them soft, and unfit for atmospheric exposure.

10. In many places, the clay is mixed or prepared for the moulder by driving round upon it a yoke of oxen, or by means of a simple machine, consisting of a beam, into which has been driven a great number of spokes. One end of this beam is confined in a central position, while the other is moved round in a sweep by animal power.

11. Machines have also been invented by the aid of which the clay may be both mixed and moulded; but these have been very little used. A machine, however, is often employed in pressing bricks which have been formed in the usual manner. The pressing is done after the bricks have become partially dry. Such bricks are employed in facing the walls of the better kinds of structures.

12. *Tiles.*—Tiles are plates used for covering roofs. They resemble bricks in their composition and mode of manufacture, and are shaped in such a manner that when placed upon a building, the edge of one tile receives that next to it, so that water cannot percolate between them. Tiles, both of burnt clay and marble, were used by the ancients; and the former continue to be employed in various parts of Europe. Flat tiles are used for floors in many countries, and especially in Italy.

THE BRICKLAYER.

1. The particular business of the bricklayer is to lay bricks in mortar or some other cement, so as to form one solid body; but he frequently constructs the foundations of buildings in rough stones, and, in some cities, he sets hewn stone in the superstructure. In the country, plastering is likewise connected with this business.

2. Bricklaying consists in placing one brick upon another in mortar, chiefly in the construction of walls, chimneys, and ovens. In connecting these materials, especially in walls, two methods are employed, one of which is called the *English bond*, and the other the *Flemish bond*. In the former method, the bricks are most commonly of one quality, and are laid crosswise and lengthwise in alternate rows. The bricks which are laid across the wall are called *headers*, and those which are laid in the other direction are called *stretchers*. The brick-work of the Romans was of this kind, and so are the partition-walls of many modern brick edifices.

3. The bricks employed in the walls constructed according to the Flemish method, are of two, and frequently of three, qualities. Those placed in the front, or on the external surface, are manufactured with greater care, and, in some cases, are formed in a larger mould. A wall put up on this principle may be said to consist of two thin walls composed of stretchers, with occasional headers, to unite them together. The space between them, when the wall is thick, is filled in with the inferior bricks.

4. The inclosing walls of all brick edifices are erected on this plan, although they are thought to be more insecure than those co[illegible] the old English method [illegible]ged for the preference, are its superior beauty, and a considerable saving in the most expensive kind of bricks. Greater security might be attained by the use of larger bricks, say sixteen inches in length, and wide and thick in proportion. Besides, an edifice constructed of well-made bricks of this size would be but little inferior in appearance to marble itself.

5. Most of the instruments used by the bricklayer are also employed by the stonemason; and they have, therefore, been already mentioned. The particular method of laying bricks, in their various applications, can be learned by actual inspection in almost every village, city, or neighbourhood, in our country: a more particular description of the bricklayer's operations is therefore unnecessary.

6. Before closing this subject, however, it may be well to state that the chimney appears to be an invention comparatively modern; since the first certain notice we have of it is found in an inscription at Venice, in which it is stated that, in 1347, a great many chimneys were thrown down by an earthquake. It is conjectured that this valuable improvement originated in Italy, inasmuch as it was here that chimney-sweeping was first followed as a business.

7. Before the introduction of the chimney, it was customary to make the fire in a hole or pit in the centre or some other part of the floor, under an opening formed in the roof, which, in unfavourable weather, could be closed by a moveable covering. Among the Romans, the hearth or fire-place was located in the atrium or hall, and around it the *lares*, or household gods, were placed. To avoid being infested with smoke, they burned dry wood anointed with the lees of oil. In warming other apartments of the house, they used

portable furnaces, in which were placed embers and burning coals.

8. It is said by Seneca, who flourished about the middle of the first century of the Christian era, that in his time, a particular kind of pipes was invented, and affixed to the walls of buildings, through which heat from a subterranean furnace was made to circulate. By this means, the rooms were heated more equally. In the southern parts of Italy and Spain, there are still very few chimneys. The same may be said of many other countries, where the climate is pleasant or very warm.

9. Hollinshead, who wrote during the reign of Queen Elizabeth, thus describes the rudeness of the preceding generation in the arts of life: "There were very few chimneys even in capital towns: the fire was laid to the wall, and the smoke issued out at the roof, or door, or window. The houses were wattled, and plastered over with clay; and all the furniture and utensils were of wood. The people slept on straw pallets, with a log of wood for a pillow."

THE PLASTERER.

1. In modern practice, plastering occurs in many departments of architecture. It is more particularly applied to the ceilings and interior walls of buildings, and also in rough-casting on their exterior.

2. In plastering the interior parts of buildings, three coatings of mortar are commonly applied in succession. The mortar for the *first coat* is composed of about twelve parts of sand, six of lime, and three of hair, with a sufficient quantity of water to bring it to the proper consistence; that for the *second coat* contains a less proportion of lime and hair; and that for the *third coat* is composed exclusively of lime and water.

3. The mortar is applied directly to the solid wall, or to thin strips of wood called *laths*, which have been fastened with small nails to the joists, and other parts of the frame of the building. The tools with which the plasterer applies the mortar are *trowels* of different sizes and shapes, and the *hawk*. The latter instrument is a board about a foot square, with a short handle projecting at right angles from the bottom.

4. In all well-finished rooms, cornices are run at the junction of the wall and ceiling. The materials of these cornices are lime, water, and plaster. The lime and water are first incorporated, and the plaster is added with an additional quantity of water, as it may be needed for immediate application. The composition is applied in a semifluid state, but the plaster causes it *to set*, or to become solid immediately. In the mean time, the workman applies to it, in a progressive manner, the edge of a solid piece of wood, in which an exact profile of the proposed cornice has been cut.

5. Ornaments of irregular shape are cast in moulds of wax or plaster of Paris, and these are formed on models of the proposed figures in clay. Such ornaments were formerly the productions of manual operations performed by ingenious men called *ornamental plasterers*. The casts are all made of the purest plaster; and, after having been polished, they are fastened to the proper place with the same substance saturated with water.

6. The branch of this business called *rough-casting*, consists in applying mortar to the exterior walls of houses. The mode in which the work is performed varies but little from that adopted in plastering the walls of apartments. It, however, requires only two coats of the cement; and when

these have been applied, the surface is marked off in imitation of masonry. It is likewise sometimes coloured, that it may resemble marble or some other stone.

7. The cement is commonly made of *sharp sand* and lime; but sometimes a kind of argillaceous stone, calcined in kilns and afterwards reduced to powder by mechanical means, makes a part of the composition. The qualities of this material were first discovered by a Mr. Parker, who obtained letters patent for this application of it, in England, in 1796; hence it has been called *Parker's cement.*

THE SLATER.

1. Slate stone is valuable for the property of splitting in one direction, so as to afford fragments of a sufficient size and thinness to answer several purposes, but especially for covering houses and for writing slates. The best slates are those which are even and compact, and which absorb the least water.

2. The slates used in the United States are obtained either from our own quarries, of which there are several, or from those of Wales, in the county of Caernarvonshire. The stone is quarried in masses, which are afterwards split into pieces of suitable thinness. These are trimmed to an oblong figure by means of a knife and a steel edge, which act upon the slate much in the manner of a large pair of shears.

3. As it is impossible to dress all the slates to the same size without much waste of material, those engaged in their manufacture have introduced several sizes, the smallest of which are made of the fragments of the larger kinds. These are designated by names known to the trade, and to those practically conversant with the art of building.

4. The slates, when brought to market, especially those from Wales, require additional dressing to fit them for use. The manner of applying them to roofs differs but little from that employed in putting on shingles, as they are lapped over each other in the same way, and confined to their place by means of nails of a similar kind. The nails, however, have a broader head, and are somewhat larger, varying in size to suit the dimensions of the slate. The holes in the slate for the nails are made with a steel point attached to the slater's hammer, or to his knife, technically called a *saix.*

5. Slates are preferable to shingles on account of their durability, and, in a majority of situations, for their fire-proof quality. They, however, are objectionable on account of their weight and expensiveness, and are therefore beginning to be superseded in this country by sheets of zinc, and by those of iron coated with tin. Copper and lead are also used for roofs, but the metals just mentioned are beginning to exclude them altogether.

6. A serious objection to metal roofs has been their liability to crack, caused by the contraction and expansion of the material, in consequence of variations in the temperature of the weather; but a particular method of putting the sheets together has been lately devised, which appears to obviate the difficulty. Tiles are not used in this country, although in Europe they are very common.

THE PAINTER, AND THE GLAZIER.

THE HOUSE AND SIGN PAINTER.

1. The painting which is the subject of this article, relates to forming letters, and sometimes ornamental and significant figures, on signs, as well as to the application of paints to houses and other structures, for the purpose of improving their appearance, and of preserving them from the influence of the atmosphere and other destructive agents.

2. The substances capable of being employed by the house and sign painter, comprise a great variety of articles, derived from the mineral, vegetable, and animal kingdoms; but he ordinarily confines his selection to but few: among which are white lead, litharge, Spanish brown, yellow ochre, chrome yellow, red ochre, terra di scienna, lampblack, verdegris, linseed-oil, spirits of turpentine, and gold-leaf.

3. White lead and litharge are manufactured in great quantities at chemical works, sometimes established for the express purpose of making these and some other preparations of lead. The substances of which we are now speaking, are produced in the following manner: the lead, in form of a continued sheet, about three feet long, six inches wide, and one line in thickness, is wound spirally up in such a manner that the coils may stand about half an inch apart.

4. The metal in this form is placed vertically in earthen vessels, at the bottom of which is some strong vinegar. These vessels, being placed in sand, horse manure, or tan, are exposed to a gentle heat, which

causes the gradual evaporation of the vinegar. The vapour thus produced, assisted by the oxygen which is present, converts the exposed surface into a carbonate of lead, the substance known as white lead, or ceruse.

5. The corrosion of one of these sheets occupies from three to six weeks, during which time it is repeatedly uncovered and scraped. Litharge, or flake white, is nothing more than the cleanest and thickest scales produced in the manner just described. It can be obtained in a pure state from the dealers in paints, whereas the white lead of commerce is most commonly adulterated with chalk.

6. Spanish brown, yellow ochre, and terra di sienna, are earths impregnated with iron in different degrees of oxydation. Red ochre is yellow ochre burned. Chrome yellow is extensively manufactured in Baltimore, from the chromate of iron, found near that city. In chemical phraseology, the manufactured article is the chromate of lead, since the chrome is separated from the iron by the aid of a solution of the nitrate or acetate of lead.

7. Linseed-oil is obtained from flax-seed by pressure. It is afterwards filtered, and then suffered to remain at rest, to precipitate and clarify. This oil improves in quality by keeping; as it becomes, in a few years, as transparent as water. In this state, it is employed in the finest painting.

8. Before the oil is used, it is commonly boiled with a small quantity of litharge and red lead, to cause it to dry rapidly, after the paint has been applied. During the boiling, the scum is removed as fast as it rises, and this is mixed with inferior

ark colour. Linseed-oil, thus

ended by dealers in paints,

of boiled oil.

turpentine is produced by distilling with water the resinous juice or sap of several species of the pine. The residuum, after distillation, is the turpentine of commerce. Spirits of turpentine is mixed with paints, to cause them to dry with rapidity. Like oil, it improves with age, and it is sold in the same manner by the common wine measure.

10. White lead, and several other principal paints, are purchased in their crude condition, and reduced to a state of minute division in paint-mills. They are afterwards mixed with boiled oil, and put up in kegs of different sizes for sale. Many articles, however, are pulverized, and sold in a dry state. The preparation of paints is commonly a distinct business, and very few painters seem to be acquainted with the mode in which it is performed.

11. In mixing colours for house and sign painting, white lead forms the basis of all the ingredients. This the colour preparer, or the painter himself, modifies and changes by the addition of colouring materials, until it is tinged with the proposed hue. The pigments derived from vegetable bodies produce, when first applied to surfaces, a brilliant effect; but they cannot long resist the combined influence of air and light; while the mineral colours, in the same exposure, remain unchanged.

12. Painters, in the execution of their work, commonly lay on three coats of paint. In communicating a white, the two first coats are composed of white lead and oil; and in the last, spirits of turpentine is substituted for the oil, for the inside work. For the outside of buildings, especially in warm and dry climates, this liquid is inapplicable, since it causes the paint to crack and flake off. It is, however, frequently used, when the painter is compelled to do his work at too low a rate, or when he is regardless of his reputation.

13. For other colours, the composition for the different coats is the same, except for the two last, in which other colouring substances are added to the materials just mentioned, to give the proposed hue. The tools for painting houses are few in number, and consist chiefly of brushes of different sizes, made of hogs' bristles.

14. *Graining* is understood, among painters, to be the imitation of the different species of scarce woods used for the best articles of furniture. But the manner in which this kind of work is executed can be hardly gathered from a concise description, although it may be easily learned from a practical exhibition of the process by a painter.

15. *Ornamental painting* embraces the execution of friezes and other decorative parts of architecture on walls and ceilings. The ornaments are drawn in outline with a black-lead pencil, and then painted and shaded, to give the proper effect. Some embellishments of this kind are executed in gold-leaf, in the same manner with gold letters on signs. This kind of work is called *gilding in oil.*

16. Painting in oil, as applied to the execution of designs, seems to have been invented, or at least to have been brought into notice, in the early part of the fifteenth century, by John Van Eyck, of Flanders. Before this time, house-painting, so far as the exterior was concerned, could have been but little, if at all, practised.

17. One profitable branch of common painting is that of painting and lettering signs. In performing this kind of work, the sign is first covered with two or three uniform coats of paint. The letters are next slightly sketched with chalk or a lead-pencil, and then formed in colours with a camels'-hair brush. When the letters are to be gilt, the process, so far, is precisely the same. The leaf is laid upon the letters while the paint is in a tenacious state, and is suffered to remain untouched until the oil has become dry; after which the superfluous gold is removed. The whole is then covered with an oil varnish, which, in plain lettering, completes the operation.

THE GLAZIER.

1. GLAZING, as practised in this country, consists chiefly of setting panes of glass in window-sashes. In the performance of this operation, the glazier first fits the panes to the sash, by cutting away, if necessary, a part of the latter with a chisel; he then fastens the glass slightly with little pieces of tin, which have been cut to a triangular shape; and, lastly, he applies *putty* at their junction with the sash, and by this means confines them firmly and permanently to their place. The putty is made of linseed-oil and whiting. The latter of these materials is chalk cleared of its grosser impurities, and ground in a colour-mill.

2. Plain glazing is so simple, that no person need serve an apprenticeship to learn it; and there are but few who confine their attention to this business exclusively. It is commonly connected with some other of greater difficulty, such as that of the carpenter and joiner, or house and sign painter; but with the latter more frequently than any other.

3. When the glass, as received from the manufacturer, may not be of the size and shape required for a proposed application, the panes are cut by means of a diamond fixed in lead, and secured by a ferule of brass, which is fastened to a small cylindrical handle of hard wood. This instrument is used, in conjunction with a straight edge, like a pencil in ruling lines

on paper for writing. The glass is afterwards broken in the direction of the fracture, by a slight pressure downwards.

4. Although glass windows seem to us to be indispensable to comfort, yet glass had been manufactured many centuries in considerable perfection before it was applied to this purpose. The houses in oriental countries had commonly no windows in front, and those on the other sides were provided with curtains or with a moveable trellis-work in summer, and in winter with oiled paper.

5. In Rome and other cities of the empire, thin leaves of a certain kind of stone called *lapis specularis* were used. Windows of this material, however, were employed only in the principal apartments of great houses, in gardens, sedans, and the like. Paper made of the Egyptian papyrus, linen cloth, thin plates of marble, agate, and horn, seem likewise to have been used.

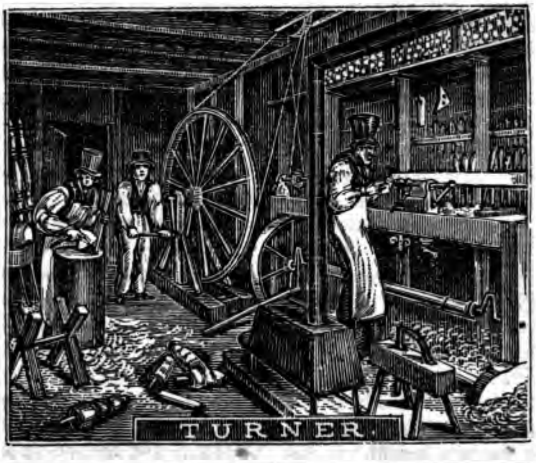
6. The first certain information we have of the employment of glass panes in windows, is found in the writings of Gregory of Tours, who flourished in the last quarter of the sixth century. This prelate states that the churches were furnished with windows of coloured glass in the fourth century after Christ.. The oldest glass windows now in existence were of the twelfth century, and are in the church of St. Denis, the most ancient edifice of this description in France.

7. Æneas Sylvius accounted it one of the most striking instances of splendour which he met with in Vienna, in 1458, that most of the houses had glass windows. In France, all the churches had these conveniences in the sixteenth century, although there were but few in private dwellings. Talc, isinglass, plates of white horn, oiled paper, and thinly shaved leather, were used instead of glass. A similar state of things prevailed in England.

8. The glass used for the windows of churches and other public buildings, after the fourth century, was very commonly intrinsically coloured or superficially painted. Painting on glass had its origin in the third century, and at first it consisted in the mere arrangement of small pieces of glass of different colours in some sort of symmetry, and constituted a kind of mosaic-work.

9. Afterwards, when more regular designs came to be attempted, such as the human figure, the whole address of the artist went no farther than drawing the outlines of the objects in black on glasses resembling in colour the subjects to be represented. The art, in this state of advancement, was spread over a great part of Europe.

10. About the beginning of the fifteenth century, a method of fixing metallic colours in glass by means of heat was discovered, and from this the art derived great advantages. It flourished most during the fifteenth and sixteenth centuries; but it declined in the following age, and in the eighteenth century it was very little practised in any country. It has, however, been partially revived, of late, in Germany. A very good specimen of this kind of painting, as well as of coloured glass, may be seen in St. John's church, at Philadelphia.



THE TURNER.

1. **Turning** is a very useful art, by which a great variety of articles are almost exclusively manufactured. Besides this, it constitutes a considerable part of the operations of several trades and occupations; such as the chairmaker, machinist, cabinetmaker, brass-founder, &c.; since every substance of a solid nature can be submitted to the process.

2. Turning is performed in a *lathe*, an apparatus constructed in various ways, according to the particular purposes to which it is to be applied; although, in all cases, the general principle of its operation is the same. The kind represented in the above picture is used for plain or circular turning in wood. On examination, it will be perceived that two wheels of different sizes make essential parts of it. On the extended axle of the smaller one, is fastened the piece to be turned; and immediately in front of this is the *rest*, on which the cutting instrument is supported during the performance of the operation.

3. When the material to be turned is wood, it is commonly cut to the proper length with a saw, and brought to a form approaching to the cylindrical by means of an axe or drawing-knife. It is next fastened in the lathe. This is done by different means, varying according to the particular form of the thing to be turned. In plain circular turning, as applied to bed-posts, legs of tables, and rounds for chairs, the piece is supported at each end. That at the left hand is driven upon a piece of steel which has been screwed upon the extended axle of the small wheel, and

the other end is fixed upon a steel point placed in an upright moveable piece, called a *puppet-head*.

4. In case the wood is to be turned on the inside, as in making a bowl, cup, or mortar, the piece is supported altogether at one end, by means of a hollow cylinder of wood, brass, or iron, called a *chuck*, which receives it on one side, and on the other is screwed upon the end of the axle. The axle is sometimes called the *mandril*, and any extension of it, by means of a piece added to it for a centre, on which anything may be turned which will admit of a hole through it, is denominated an *arbour*.

5. The tools used in turning wood and ivory are *gouges* and *chisels*, of different sizes and shapes. In using these, they are placed upon the *rest*, and brought in contact with the revolving material of the proposed figure. The gouge is employed in cutting away the rough exterior, and the chisel in producing a still further reduction, and a greater smoothness of surface.

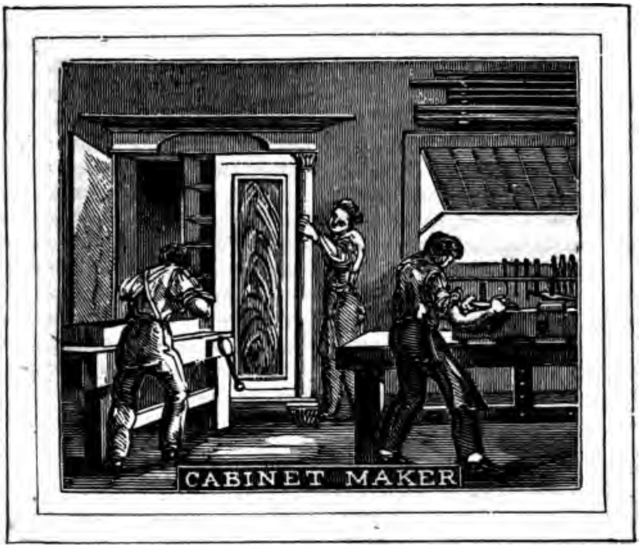
6. In working in very hard wood and in ivory, the *grooving tool*, a sharp pointed instrument, somewhat similar to the graver, is used in the first part of the operation; and by this the grain of the substance is cut into contiguous grooves, and prepared for an easy reduction by the chisel. The instruments for turning metals are numerous, but they differ in some respects from those for cutting wood.

7. In almost every kind of turning, a tool called the *calipers* is necessary for measuring the diameters of the work. In its form, it bears some resemblance to the compasses or dividers. One or both of the legs, however, are curved; and one kind of this instrument has four legs, two curved, straight, at each end, with a pivot e, on which it is opened and rmer of these is employed in measuring the dimensions of outside work, and the latter for that on the inside. This kind is called the *in-and-out* calipers; and is especially useful in turning a cylinder, or pin, which shall exactly fit an internal cylinder already made, and *vice versâ.*

8. There is but little difference in the management of turning different substances. The principal thing to be attended to is to adapt the velocity of the motion to the nature of the material: thus wood will work best with the greatest velocity that can be given to it. Brass should have a motion about half as quick as wood, and iron and steel still less; for, in operating on metallic substances, the tool is liable to become hot, and lose its temper; besides which, a certain time is requisite for the act of cutting to take place.

9. When compared with many other mechanical operations, the art of turning may be considered as perfect in its accuracy and expedition. The lathe is, therefore, resorted to for the performance of every work of which it is capable; nor is its use confined to the production of forms perfectly cylindrical, for it can be easily made to produce figures of irregular shape, such as lasts, gunstocks, &c.

10. The lathe was well known to the Greeks and Romans, as well as to many other nations of antiquity. Diodorus Siculus, who wrote in the time of Julius Cæsar and Augustus, says that it was invented by one Talus, a nephew of Dædalus. Pliny ascribes it to Theodore of Samos, and mentions one Thericles, who had rendered himself very famous by his dexterity in managing the lathe. The Greek and Latin authors frequently mention this instrument; and, among the ancients, it was customary to express the accuracy and nicety of a thing by saying it was formed in a lathe.



THE CABINET-MAKER, AND THE UPHOLSTERER.

THE CABINET-MAKER.

1. It is the business of the cabinet-maker to manufacture particular kinds of household furniture, such as tables, stands, bureaus, sideboards, desks, bookcases, sofas, bedsteads, &c., as well as a certain description of chairs made of mahogany and maple. Many of the operations of this business are similar to those of the carpenter and joiner, although they require to be conducted with greater nicety and exactness.

2. The qualifications of a finished cabinet-maker are numerous and of difficult acquisition; so that they are seldom concentrated in any single individual. He requires not only a correct taste, but also a knowledge of drawing, architecture, and mechanics, besides the abilities of a good practical workman.

3. A knowledge of drawing is especially useful in designing new articles of furniture, or in improving the form of those which have been already introduced. It also enables the artist to determine with accuracy what would be the general effect of furniture, were different pieces of it placed in any proposed apartment; and, combined with architectural knowledge, it enables him to adapt the style of his wares to that of the building for which they may be designed.

4. In general, the principles of this business are fixed, so far as relates to the mode of operating in the execution of the work; yet continual changes are made in the

form and construction of its various articles, so as to keep pace with the advancement of correct taste, or with the caprices of fashion. In fact, the shapes of furniture are almost as changeable as those of female dress; and this causes many expensive pieces to fall into disuse, while others are introduced, which, for a time, are considered indispensable to comfort, and which in turn enjoy but a temporary favour.

5. The cabinet-maker uses various kinds of wood in the manufacture of his wares; but those which are most frequently employed in the United States are pine, maple, poplar, cherry, black walnut, white oak, beach, mahogany and rose, all of which are abundant in this country, except the two last. Mahogany is brought in great quantities from the West Indies and South America; rose-wood is obtained chiefly from the West Indies and Brazil, although it was first introduced into notice from the island of Cyprus.

6. The applicability of mahogany to the manufacture of cabinet-ware was accidentally discovered in London, about the year 1724. A physician named Gibbons received a present of some of the planks from his brother, a sea-captain, who had brought them from the West Indies chiefly as ballast. The doctor was, at that time, erecting a house; and, supposing them to be adapted to the purposes of building, gave them to his workmen, who, on trial, rejected them as being too hard to be wrought with their tools.

7. A cabinet-maker was next employed to make a candle-box of some of it, and he also complained of the hardness of the timber; but when the box was finished, it outshone in beauty all the doctor's other furniture. [illegible] then required a bureau to be m[illegible] kind of material; and [illegible]ed, became the subject of exhibition to his friends, as a piece of remarkable beauty. The wood was immediately taken into general favour, and it soon became an article of merchandise of considerable importance.

8. In giving the reader a view of the operative part of this business, we have selected the bureau as affording the best means of illustration. The material which composes the frame and drawers of this piece of furniture is commonly some kind of soft wood, such as pine or poplar; and this is faced with thin layers of mahogany in those parts which are to be exposed to view.

9. The materials for the frame and drawers are first marked out, and the several pieces reduced to the form and dimensions required, with planes and other instruments. Thin pieces of mahogany are firmly fixed to the surfaces which require them. This part of the work is called *veneering*. The workman prepares the surface of the soft wood for the *veneer*, by cutting it into small contiguous grooves, by means of a small plane, the cutting edge of which is full of little notches and teeth.

10. Melted glue having been spread upon both surfaces with a brush, the parts are placed in contact, and firmly pressed together by means of *hand-screws*. Before the screws are applied, the surface of the veneer is covered with a piece of heated board, termed, in this application, a *caul*. One piece of this kind commonly serves a veneer on each side of it at the same time.

11. The mahogany thus attached to the softer wood, is afterwards wrought with the *toothed-plane*, and others of the common kind. It is then scraped with a flat piece of steel, having edges which act upon the surface in the same manner with pieces of broken panes of glass. The

polishing is finished, so far as it is carried at this stage of the process, by the use of sand-paper.

12. The several pieces which compose the frame of the bureau are put together with the joint called *mortice* and *tenon;* and those which form the four sides of the drawers, with that called *dovetail.* The bottom is united to the sides on the right and left, and sometimes in front, by the *groove-and-tongue*, and its rear edge is fastened with a few nails. The *bearers* of the drawers are fastened on by means of nails.

13. The joints are made to fit not only by the accuracy of the work, but by the application of glue previously to the union of the parts: this is especially the case with the mortice and tenon. The back of the bureau is composed of some cheap wood, such as pine or poplar; but the panel at each end is most commonly plain mahogany through its entire thickness.

14. The parts which are to be exposed to view are next to be varnished and polished. The material for the former purpose is called *copal varnish*, because one of the principal ingredients in it is a kind of gum called copal, which is obtained from various parts of America. This kind of varnish is made by melting the gum with an equal quantity of linseed-oil, spirits of turpentine, or alcohol.

15. To give the work a complete finish, four coats of varnish are successively applied; in addition to these, a particular kind of treatment is used after the laying on and drying of each coat. After the application of the first coat, the surface is rubbed with a piece of wood of convenient form; after the second, with sand-paper and pulverized pumice-stone; after the third, with pumice-stone again; and after the fourth, with very finely powdered pumice-stone and rotten-stone. A little linseed-oil is next applied, and the whole process is finished by the application of flour, and by friction with the hand.

16. Some parts of several pieces of furniture are turned in the lathe; and, in large cities, this part of the work is performed by professed turners. The veneering of certain kinds of work of a cylindrical form is also, in some cases, a distinct business; but, in places distant from large cities, the whole work is commonly performed by the cabinet-maker himself.

17. Mahogany is brought to market in logs hewn to a square form; and persons who deal in it commonly purchase it in large quantities, and cause it to be sawn into pieces of suitable dimensions for sale. Formerly, and in some cases at present, slabs were sawn into thin pieces for veneering, by hand; but, within a few years, a more expeditious method by the circular saw has been adopted. In performing the operation by this means, the slab is placed upon its edge, and shoved along against the teeth of the rapidly-revolving saw. It is kept in the proper position by holding the right side of it firmly against an upright plank called the *rest.*

18. Mahogany is either *plain*, *mottled*, or *crotched:* nevertheless, the different kinds expressed by these terms are met with in the same tree. The variegated kinds are found at or near the joining of the limbs to the trunk; and these are used almost exclusively for veneering. The plain sort is employed for more common purposes, and in those parts of furniture required to be less splendid in appearance. It may be well to remark, also, that plain mahogany is often veneered as well as the softer woods. Black walnut, white oak, rose, and several other woods, are likewise used for veneering, although not so much

as mahogany. Our native woods will be hereafter more used in this way, since mahogany is gradually becoming more scarce.

19. In Europe, particularly in England, the business of the cabinet-maker is commonly united with that of the upholsterer; and this is sometimes the case in the United States. All, however, who make sofas and chairs intrude enough upon the latter business to cover and stuff them, or they employ a journeyman upholsterer to perform this part of the work.

THE UPHOLSTERER.

1. The upholsterer makes beds, sacking-bottoms, mattresses, cushions, curtains for windows and beds; cuts out, sews together, and fastens down, carpets. One branch of his business, also, consists in covering, or lining and stuffing sofas and particular kinds of chairs, the frames of which are made by cabinet-makers and fancy chair-makers.

2. Beds are stuffed with the feathers of geese and ducks. The sack which contains them, when in use, is called a *tick*, and the striped stuff of which it is composed is called *ticking*. The feathers used by the upholsterer are purchased from the feather-merchants, who in turn procure them from country merchants and pedlars. The dealer in feathers also employs travelling agents to collect them in different parts of the country.

3. Beds and pillows are also made of down obtained from the nests of the eider-duck, which is found in the northern parts of Europe and America, above latitude 45°. Eider-down is worth about two dollars per pound [illegible] six times that quantity [illegible] common size. [illegible] of curled hair, moss, shavings of rattan, flock, straw, and cat-tail flag. The hair most employed for this purpose grows upon the tails of cattle, and upon the manes and tails of horses. It is purchased, in its natural state, from tanners, by persons who make it a business to prepare it for use. The last process of the preparation consists in twisting it into a kind of rope: these ropes are picked to pieces by the upholsterer, and the hair, in its curled and elastic state, is applied to stuffing mattresses, cushions, chairs, and sofas.

5. Moss is obtained from the Southern States of our Union, where it is found in great abundance, and of a good quality. Flock is made by reducing to a degree of fineness, by machinery, coarse tags of wool, pieces of woollen cloth, old stockings, and other woollen offals of little or no value in any other application. Of all the materials for stuffing upholstery, hair is by far the best; and, although it costs more in its original purchase, it is much cheaper in the end.

6. In making and putting up window and bed curtains, considerable taste is required to insure success in this branch of the business. A knowledge of drawing is, therefore, particularly useful here, in improving the taste, as well as in exhibiting to customers the prevailing fashions, or any changes which may be proposed. The trimmings consist chiefly of tassels, fringes, and gilded or brass fixtures.

7. We have not space for a particular description of the manner in which any of the operations of the upholsterer are performed; nor is this necessary, since the work itself, in almost every specimen of it, affords obvious indications of the manner of its execution. We will merely remark, that a great proportion of it is performed by females.

8. In the first ages of the world, it was the universal practice to sleep upon the skins of beasts, and this is still the custom among the savage nations of the present day. The Greeks and the Romans, in the early part of their history, slept in this manner, and so did the common people of some parts of Germany, even until modern times.

9. The first advancement from the use of skins was the substitution of rushes, heath, or straw, which was primarily strewed loosely on the ground or floor, and finally confined with ticking; and these and similar materials are still used by the poor in various parts of the world. So late as the close of the thirteenth century, the royal family of England slept on beds made of straw.

10. During the civilized periods of antiquity, the wealthy commonly filled their beds with feathers. After the Romans had become luxurious, they used several kinds of beds, among which were the *lectus cubicularis*, or chamber bed, whereon they slept; the *lectus discubitorius*, or table bed, whereon they eat; and the *lectus lucubratorius*, on which they studied.

11. The Romans adopted the eastern fashion of reclining at their meals at the close of the second Punic war, about 200 years before Christ, when Scipio Africanus brought some little beds from Carthage, which were thence called *Punicani*. These beds were low, made of wood, covered with leather, and stuffed with hay or straw. Before this time, they sat down to eat on plain wooden benches, in imitation of the heroes of Homer, or after the manner of the Cretans and Lacedæmonians.

12. From the greatest simplicity, the Romans at length carried their supping beds to the most surprising magnificence. The bedsteads were sometimes made of gold or silver, and very commonly of wood adorned with plates of these metals or with tortoise shell. On the couch was laid a mattress or quilt, stuffed with feathers or wool.

13. Three persons commonly occupied one couch. They lay with the upper part of the body reclined on the left arm, the head a little raised, the back supported by cushions, and the limbs stretched out at full length or a little bent. The feet of the first were placed behind the back of the second, and his feet behind the back of the third. Reclining at meals was customary in Asia in the time of our Saviour, as is clearly shown in John, xiii. 23 and 25, and this rendered it convenient for Mary to anoint the feet of Jesus while at the table.

14. The Romans, during the republic, made their tables of a square form, and on three sides of it was placed a couch; but, under the emperors, a long couch of a semicircular form having been introduced, the table was made of a similar shape to conform to it. In either case, one side was left empty to admit of the approach of the servants.

15. We have no certain evidence that carpets were known in the civilized periods of antiquity. They appear to have originated in Persia at a time comparatively modern, and to have spread in a gradual manner towards the west. They were unknown in England in the reign of Elizabeth, for it was then the fashion to strew the floor with hay and rushes. Even the presence-chamber of this princess was covered in this manner. The manufacture of carpets was not commenced in England until the year 1750. They are now extensively manufactured even in the United States.

THE CHAIR-MAKER.

1. The chair was invented at so early a period, that its origin cannot now be ascertained. It was used by all the civilized nations of antiquity; and some of their patterns for this species of furniture have been revived, with some modifications, in modern times: for example, a stool for sitting at the piano, now called the X, is the lower part of a chair used in the Roman empire near two thousand years ago. The seat and back were stuffed with some soft elastic substance.

2. The seats used by the barbarous conquerors of the Roman empire hardly deserve the name of chairs, as they commonly consisted of little or nothing more than a stool with three or four legs. Even the [illegible] who swayed the sceptre of [illegible] latter part of the ninth century, possessed nothing approaching nearer to a chair than a three-legged stool made of oak timber. This species of seat was at length improved into a chair, by the addition of another leg and a back.

3. The next step in the art of chair-making was to cover the seats with cloth, and to stuff them with some kind of wadding. The material of which the frames were made was oak; and, for a long period, they were exceedingly heavy and inconvenient. The armed-chair is said to have been contrived by an alderman of Cripplegate. Such chairs, however, were in use among the ancient Greeks and Romans.

4. Our old-fashioned chair, with four upright posts, several horizontal rounds and slats, together with wooden splints or flags for the bottom, is comparatively mo-

dern, although it is impossible to state the period of its introduction. Very few of any other kind were used in the United States until near the beginning of the present century.

5. The Windsor chair seems to have been first used for a rural seat in the grounds about Windsor castle, England; whence its name. It was originally constructed of round wood, with the bark on; but the chair-makers soon began to make them of turned wood, for the common purposes of house-keeping. We cannot learn that any were made in this country before the close of the revolution in 1783.

6. A great proportion of the chair-maker's stuff is brought to the proper form by means of the lathe; and this machine is used for this purpose in every practicable case: but this part of the work is not performed in the cities, since it is found to be less expensive, and more convenient, to purchase the timber turned in the country. Slats for the back, bent to the proper shape, are also obtained from the same source.

7. The Windsor chair is varied in its construction and finish, in some particulars; but, in all cases, it has a seat made of thick plank of cypress, bass, or some other soft wood. The slats, when employed, are also made of the same wood, or of soft maple. The parts which are turned are commonly of the wood last mentioned.

8. In constructing chairs from these materials, the workman undertakes several at a time, say from one to two or three dozens. We may suppose, as is frequently the case, that he first cuts up a quantity of planks to the proper size for the seats, and reduces them to the proposed form and smoothness by means of the drawing-knife, adze, spoke-shaves, and sand-paper. He next cuts the various pieces which are to compose the frame to the proper length; turns the ends of those which need it, to make the joint; and bores the requisite holes with a *bit*. In putting the parts together, the joints are made to fit very closely, and their union is rendered permanent by means of glue.

9. The chairs are next covered with three coats of paint, and with two coats of copal or some other kind of varnish; and this, for plain work, completes the whole process of the manufacture; but when they are to be ornamented, gold or copper leaf, or bronze, is put on before the application of the last coat of varnish. The bronze used by painters is finely pulverized copper, tin, or zinc.

10. The *ornamenter* uses paper patterns, which he applies to the surface to be ornamented, to guide him in the execution of his work. The powder is laid on with a camel's-hair brush, or with a piece of raw cotton. Light and shade are produced by a proper distribution of the powder, or by paint of a dark colour. The bronze is made to adhere by means of *size*, which has been previously laid on.

11. Several other kinds of chairs are also made by the common chair-maker; and the frames, or some parts of them, are sawn out of planks, with a narrow-bladed saw, which can be easily guided upon the line of any pattern. The principal parts of the frame are commonly put together with the mortice and tenon; and the bottoms are composed of cane, flags, or a peculiar kind of rush. The cane is likewise used in the backs of chairs, especially in those having rockers.

12. The manufacture of mahogany chairs with stuffed seats, sometimes constitutes a distinct branch of business; at other times, it is connected with that of making sofas; and again with cabinet-making in general.

THE CARVER, AND THE GILDER.

THE CARVER.

1. CARVING, in its widest sense, is the art of forming figures in various hard substances by means of some cutting instruments, such as a chisel or graver; but in the restricted sense in which the term is generally applied, it has reference to the production of figures in wood.

2. Carving in wood, in all countries where it has been practised, has ever preceded sculpture or carving in stone. It is, therefore, an art of the highest antiquity; and, although the same with sculpture in some of its applications, yet it differs from it somewhat in the mode of execution, according with the nature of the material.

3. The art of carving is very extensive in its application, being used in the *decorative parts of architecture,* both civil and naval, and likewise in ornamenting cabinet-ware, as well as in forming patterns for casting in metals, particularly in iron and brass. The Gothic style of architecture is peculiarly rich in carved work, and the productions of some ages are more so than those of others.

4. The style of Louis the Fourteenth, of France, so called because practised in his reign, was more overloaded with ornament than any other. A lighter and more beautiful style succeeded, which is still employed for some purposes; but generally the chaste and simple line of Grecian ornament now prevails.

5. In executing any proposed work, a drawing is first made on paper, commonly with a lead-pencil. The part of the paper not embraced in the outline is then cut

away, and the remaining portion is laid upon the surface of the wood. The outlines are next drawn on the wood, by moving the pencil around those on the paper. The design having been thus transferred, the superfluous portions of the wood are cut away, with carving tools; of which there is a considerable variety, both of size and form. The tools are driven with a mallet or with the palm of the hand, but in most cases with the latter.

6. A capacity for designing, and a knowledge of drawing and modelling, are particularly necessary, to make a finished carver. Without these qualifications, at least in some degree, one may be a mechanic, but not an artist. The subject most difficult of execution is the human figure, and in producing it with accuracy, the same qualifications in the artist are required, and the same general process is pursued, as in producing it in marble.

THE GILDER.

1. Carving and gilding are, in most cases, ostensibly united as one business, although in fact they are branches of manufacture totally distinct. The gilder, therefore, who writes over his door, "Carver and Gilder," seldom has any practical knowledge of carving. For every thing in this line of work, he is dependent on the carver, who commonly pursues his business in a private way.

2. The operation of gilding, as performed by those whose business is now under consideration, is executed chiefly on wood. It is employed most frequently for picture and looking-glass frames, and for upholstery fixtures. It is a mechanical process, and consists in applying gold leaf to surfaces, in such a manner as to adhere with tenacity.

3. Before the application of the metal, a tedious process must be performed, by way of preparation. The surface to be gilded is successively covered with from five to seven coats of glutinous size, made by boiling scraps of parchment in water, with the addition of a little whiting. The average thickness of the coat thus produced, is about one-sixteenth of an inch.

4. The surface is next rubbed with freestone and pumice stone, of a shape corresponding with the pattern of the frame, while a small quantity of water is occasionally applied, to increase their effects. After this, the sizing is rendered still smoother, by friction with sand paper. This surface is then covered with three coats of *burnished gold size*, which is composed of English pipe clay, venison suet, and French bole, or red chalk, mixed in a suitable quantity of weak parchment size. The preparation is completed by rubbing the surface with worn sand paper, by washing it in water with a sponge, and by rubbing it with a piece of cloth.

5. The leaf is laid on with a broad, but thin brush, called a *tip*. Before the gold is applied, however, the surface is well wet with alcohol and water. When dry, the parts designed to be bright, are burnished with a polished agate or flint. In the best kind of work, a second coat of the leaf is required. In gilding irregular surfaces, such as the ornaments at the corners of the frames, a size made of linseed oil, white lead, yellow ochre, and japan, is laid on a few hours before the application of the leaf. This is called *gilding in oil*.

6. The ornaments on the frames are cast in moulds, and are made of a composition of glue, whiting, rosin, turpentine, and Burgundy pitch. The moulds are taken from patterns, originally executed by the carver.

THE COOPER.

1. The cooper manufactures casks, tubs, pails, and various other articles for domestic use, as well as vessels for containing all kinds of liquids and merchandise of a dry nature. He also applies hoops to boxes which are to be transported, with their valuable contents, to a distance from the cities.

2. The productions of this art being of prime necessity, the trade must have been exercised at a very early period. Roman writers on rural economy speak of the existence of its productions more than two thousand years ago; nevertheless they are still unknown in some countries, and there the inhabitants keep or carry liquids in skins [illegible] over with pitch.

[illegible] kind were used, more [illegible] the Roman empire, in the days of our Saviour; and to such he alluded, when speaking of putting new wine into old bottles. Earthern vessels, of various dimensions, were also in extensive use at the same time. The custom of keeping wine in such vessels is still common in the southern parts of Europe. Pliny gives to the Piedmontese the merit of introducing casks. In his time, they were daubed with pitch.

4. Cedar and oak are the woods chiefly employed as materials in this business; and the persons who carry it on, as well as journeymen, confine their attention to the production of wares from one or the other of these woods: hence the division of the workmen into *cedar coopers* and *oak coopers*.

5. It is not always the case, however,

that every cooper executes all kinds of work belonging to either one of these divisions of the trade; but this is not because there is any peculiar difficulty attending any part of the business, but because some particular kind of coopering is required in preference to others: for example, in some places flour barrels are the casks most needed; in others, those for sugar, tobacco, pearl-ash, or some kind of spirits.

6. In illustrating the general operations of this business, we will describe the process of making a tub. The timber is first cut to the proper length with the kind of saw used in the cities for cutting fire-wood. It is next split into pieces with a *frow*, the curvature of which corresponds, at least with some degree of exactness, to that of the proposed vessel. The several pieces are then shaved on the edges with a straight *drawing-knife*, on the inside with one of a concave form, and on the outside with one of corresponding convexity.

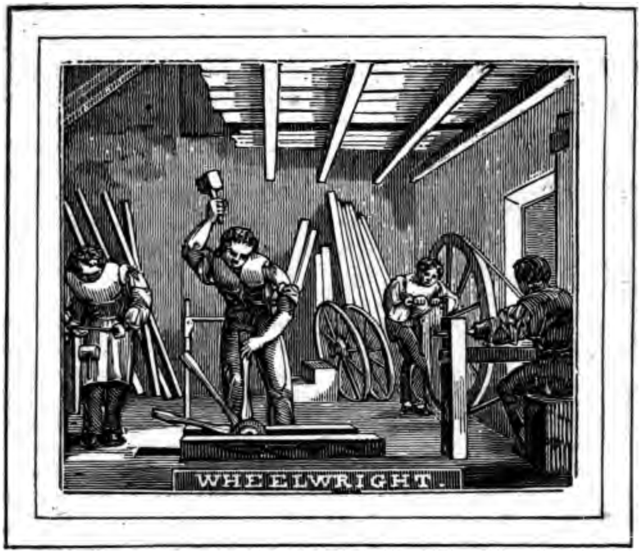
7. After this, they are jointed on a long plane, which is placed with its face upwards, in an inclined position. The workman is guided in giving the proper angle to the surface cut with the plane by a wooden gauge of peculiar form. The staves, having been thus prepared, are set up in a *truss hoop;* and after this has been driven down, one or two others which are to remain are put on. The outside is then made smooth with a convex drawing-knife, and the inside with a smoothing-plane, the edge of which is circular, to correspond with the form of the surface. The inside of small wooden vessels is generally made smooth with a crooked drawing-knife.

8. The staves are now sawn off to a uniform length at the bottom, and a groove is cut for the insertion of the bottom. The latter operation is performed by means of a cutting instrument fixed in a kind of gauge. The several pieces to compose the bottom are brought to the proper form and smoothness with a straight drawing-knife; and having been slightly fastened together by wooden pins, the whole, as one piece, is inserted in its proper place by driving it down from the top on the inside. The whole process is finished by driving on the hoops, and making the holes in the handles.

9. The cedar employed in this business is a considerable tree, which grows in various parts of the world, but especially in the United States, where it occupies large tracts called *cedar* or *cypress swamps.* The wood is soft, smooth, and of an aromatic smell. It is likewise much used for shingles. The Dismal Swamp, lying in Virginia and North Carolina, contains an abundance of this kind of timber.

10. The operations in oak vary from those in cedar so far as to conform to the nature of the material, and the form of the vessels manufactured. In bringing the staves to the proper form, the workman is guided altogether by the eye; and, if they must be bent, they require to be heated. The fire for this purpose is made of shavings and chips in a small furnace of sheet iron, called a *crusset.* The hoops, both for cedar and oak wares, are made of thin strips of iron, or of small oak, hickory, ash, or cedar saplings.

11. The coopers in England derive a great deal of their employment from the West India trade. Barrels, puncheons, and hogsheads, are carried out of the country filled with dry goods, and are returned filled with rum and sugar. In the United States, much work of this kind is done for the same market; but then the staves and heads are only fitted and marked here, to be afterwards put together in the West Indies.



THE WHEELWRIGHT.

1. The artisan who makes the wood-work of common wheel carriages, or the wheels of coaches, is denominated a wheelwright; but under this head we propose to include whatever we may say on the construction and finishing of wheel carriages in general.

2. It must be evident, even to a superficial observer, that this business, in its different branches, occupies a large space in our domestic industry; since almost every farmer in the country owns a vehicle of some sort, and since the streets of our busy cities and towns exhibit, during a great part of the day, scenes of bustle occasioned, in a great measure, by the passing and repassing of carriages of different kinds.

3. *The principal kinds of* wheel carriages made in this country are the cart, wagon, gig, and coach; and of each of these there are various sorts, differing in strength and mode of construction, to suit the particular purposes to which they are to be applied. The business of making these vehicles is divided into a number of branches; but, as the manufacture of the coach embraces a greater variety of operations than any other species of carriage, we have selected it as affording the best means of explaining the operations of the whole business.

4. In large establishments for making coaches and other vehicles of the best workmanship, the operators confine their attention to the execution of particular parts of the work: for example, one man makes the wheels, another the carriage

and body, another fashions and applies the iron, another does the painting and polishing, and another the trimming. In smaller establishments, a greater proportion of the work is executed by one person.

5. The wheels of the coach, as well as those of every other vehicle in which they are used, are composed of a *hub*, and several *spokes* and *felloes*. The hubs are commonly made of a kind of tough wood, called *gum*, which is reduced to the desired form in the lathe. The hole through the centre is made with a common auger, and enlarged with one tapering towards the point, and having through its whole length two cutting edges. The mortices for the spokes are made with a chisel driven with a mallet.

6. The spokes are made of white oak, and the felloes of ash or hickory; and both are brought to the required form and smoothness with the saw, axe, drawing-knife, spoke-shave, chisel, and sand-paper. The constituent parts of the *carriage* or *running gears* are the *axles*, *perch*, and *spring-beds* or *bolsters*, to which are added the *tongue* or *pole*, and some other parts connected with it.

7. The joints in this part of the vehicle are made perfectly tight by the application of putty; whereas, in the body, glue is used for this purpose. The latter substance will not answer in the former case, since it cannot bear exposure to water. The wood generally employed for the carriage part, as well as for the frame of the body, is ash; and the several parts are sawn from planks of suitable thickness. In this part of the work, the operator is guided by patterns made of thin pine boards. The panels of the body are made of thin boards of poplar or bass-wood. The manner in which the several parts are dressed and put together is too obvious to need description.

8. The wheels and carriage, after having received one coat of paint, are sent to the blacksmith to be ironed. The hub is bound, at each end, with hoops of iron, commonly plated with brass or silver, and the outside rim or felloes are bound with an iron *tire*, and fastened with strong nails or spikes. The tires are made red-hot before they are applied, that they may be made to fit in every part with accuracy.

9. Bands, bolts, or strips of iron, are applied to those parts of the wood-work which may be exposed to friction, or which require additional strength. The axles are also made of wrought iron, either by the blacksmith who executes the other iron-work, or by persons who manufacture them by the quantity for sale. The same remark is applicable to the *thorough-boxes*, which are inserted into the hub to prevent injury by friction, and to cause the wheel to revolve with freedom and accuracy.

10. The painting, varnishing, and polishing, of the body of the coach, when done in the best manner, embrace a tedious process. It is first covered with a coat of paint: the grain of the wood is then filled up with putty, and the surface is again covered with paint. Five coats of *filling*, composed of ochre, japan varnish, and spirits of turpentine, are next successively applied. After the surface has been rubbed with a solid piece of pumice-stone, it is again painted, and rubbed with sand-paper. Several coats of paint are next laid on, and the work is finished by the application of a few coats of copal-varnish, and by the use of pumice-stone. The painting and varnishing of the wheels and carriage part is far less expensive and tedious.

11. The nature of the trimmings, and the manner in which they are put together and applied, need not be described,

since a few moments' inspection of a finished vehicle of this kind will give any one a clear conception of the whole of this branch of the business. So far as trimming the inside and the manufacture of cushions are concerned, the operations are similar to those of the upholsterer.

12. Wheel carriages may be classed among the primitive inventions; although the first authentic notice we have of their use we find in the scripture history of Joseph, the son of Jacob, in which it is related that this great and good man "was made to ride in the second chariot" of the king's, and that he sent wagons from Egypt to convey thither his father and family from the land of Canaan.

13. Covered wagons were used in the days of Moses; and the wandering Scythians, in the time of the Romans, had them covered with leather. The seat for the driver is said to have been invented by Oxylus, an Ætolian, who took possession of the kingdom of Elis, about 1100 years before Christ. Many of the nations of antiquity used chariots in the field of battle, and the axles were sometimes armed with scythes, or some other sharp cutting instruments. Two persons commonly occupied one vehicle, one of whom drove the horses, and the other fought the enemy. The inhabitants of the promised land fought in chariots, even before the settlement of the people of Israel in that country; and the Greeks likewise employed them, for warlike purposes, at the siege of Troy.

14. The carriages used by the Romans were of various kinds, some of which were carried on the shoulders of men, and others, having two or four wheels, were drawn by horses, asses, mules, or oxen. Nevertheless, *neither they, nor any other nation of antiquity, ever suspended* the body of any carriage on leathers, or supported it on springs; and the use of almost every species of vehicle for the conveyance of persons was banished by the policy of the barbarous nations that afterwards became masters of civilized Europe; the feudal lords conceiving it important that their military vassals should serve them on horseback.

15. Even as late as the sixteenth century, ministers rode to court, and magistrates of imperial cities to council, on the back of this animal; and, in the same manner, kings and lords made their public entry on the most solemn occasions. In accounts of papal ceremonies which occur during several centuries, we find no mention of a state-coach; but, instead of it, state-horses or state-mules. The horse for his holiness was required to be a gentle and tractable nag, of a gray colour; and a stool with three steps was necessary to aid him in mounting. The emperor or kings, if present, held his stirrup, and led his beast. Bishops also made their public entrance on horses or asses richly decorated.

16. Covered carriages, however, were known in the principal states of Europe in the fifteenth and sixteenth centuries; but they were at first used only by women of rank, since the men thought it disgraceful to ride in them. At this period, when the electors of the German empire did not choose to be present at the meetings of the states, they excused themselves to the emperor by stating that their health would not permit them to ride on horseback, and it was not becoming for them to ride like women.

17. But, for a long time, the use of carriages was forbidden even to women; and, as late as the year 1545, the wife of a certain duke obtained from him, with great difficulty, the privilege of using a covered

carriage, in a journey to the baths. The permission was granted on the condition that her attendants should not enjoy the same favour. Nevertheless, it is certain that emperors, kings, and princes, began to employ covered carriages on journeys, in the fifteenth century; and a few instances occur of their use in public solemnities. Ambassadors appeared, for the first time, in coaches, at a public solemnity, in 1613, at Erfurth.

18. In the history of France, we find many proofs that, in the fourteenth, fifteenth, and sixteenth, centuries, the French monarchs commonly rode on horses, the servants of the court on mules, and the princesses, together with the principal ladies, sometimes at least, on asses. Carriages of some sort, however, appear to have been used at a very early period there. An ordinance of Philip the Fair, issued in 1294, forbids their use by the wives of citizens.

19. In the year 1550, three coaches were introduced into Paris; one of which belonged to the queen, another to Diana de Poictiers, and the third to Raimond de Laval, a cavalier of the court of Francis I. who was so large that no horse could carry him. It is not certain, however, that the body of these vehicles were suspended on leather straps. The inventor of this material improvement cannot be ascertained, nor is it positively determined that it had been made, until about the middle of the seventeenth century.

20. Coaches were introduced into Spain and Portugal in the year 1546; and into Sweden near the close of the same century. In the capital of Russia, there were elegant coaches as early as the beginning of the seventeenth century. In Switzerland, they were rare as late as 1650. Carriages began to be used at Naples in the thirteenth century; from this place they spread all over Italy; and here, also, glass panels originated.

21. Carriages of some sort were used in England at a very early period, and those first employed by the ladies were called *whirlicoats*. According to some authors, coaches were introduced in the year 1555; but, according to others, not until twenty-five years after this period. Before the latter date, Queen Elizabeth, on public occasions, rode on the same horse with her chamberlain, seated behind him on a pillion; although, in the early part of her reign, she owned a chariot.

22. In 1601, men were forbidden the use of the coach by act of Parliament, the legislators supposing such indulgence to be too effeminate; but this law seems to have been little regarded, as this vehicle was in common use about the year 1605. Twenty years after this time, hackney coaches began to ply in London; but these were prohibited in 1635, on the alleged ground that the support of so many horses increased the expense of keeping those belonging to the king. Two years after this, however, fifty coaches were licensed, and in 1770 there were one thousand.

23. The stage coach was first employed in France, and was introduced into England near the middle of the eighteenth century by Jethro Tull, the celebrated agriculturist. They were not employed, in any country, in the transportation of the mail, until the year 1784. Before this time, it was carried chiefly on horseback.

24. In the United States, the manufacture of carriages of every kind has greatly increased within a few years, and those lately made exhibit many improvements on those of former periods. The places which seem to be most distinguished for the manufacture of good carriages in this country are Philadelphia, Newark, and Troy.

THE POTTER.

1. The artisan called the potter converts plastic materials into hard and brittle vessels of various kinds, denominated, in general terms, *earthen ware.*

2. Alumine is the basis of all clays, and is the only earth that possesses the degree of plasticity which renders the operations of the potter practicable. It is, however, never found or used in a pure state, but in combination with other substances, particularly with silex, lime, magnesia, and the oxyde of iron.

3. In the manufacture of vessels from argillaceous compounds, the different degrees of beauty and costliness depend upon the quality of the raw materials, and the labour and skill expended in the operation. The various productions of the pottery may be classed under the following denominations—common earthen ware, white earthen ware, stone ware, and porcelain; but of each of these, there are many varieties.

4. *Common earthen ware.* This ware is made of a kind of clay very generally diffused over the earth, and which is essentially the same with that employed in making bricks. The potters are often supplied with this material by the brickmakers, who select for them that which is too tenacious, or *fat*, for their own purpose. All common clays contain more or less of the oxyde of iron, which causes the wares made of them to turn red in burning.

5. In preparing the clay for use, the potter adds to it, when necessary, a portion of fine loam, in order to lessen its tenacity, and to prevent the vessels to be made

of it from cracking while undergoing the fire. When the materials have been mixed, and partially incorporated with water, the mass is thrown into a tub, fixed in the ground about one-half of its depth. In the centre of this tub, is placed a shaft, in a perpendicular position, from which radiate in a horizontal direction a number of knives or cutters.

6. This machine is put in motion by horse-power, and by it the clay is repeatedly cut, and properly kneaded. The workman then cuts it into thin slices with a small wire, and having rejected all matters not fit for his purpose, he further kneads it with his hands, and forms it into lumps corresponding in amount of matter with the different vessels which he proposes to make.

7. For the best kinds of this ware, the same species of clay is used; but then it is differently prepared. It is first dissolved in water; and when the coarser particles have settled to the bottom of the vessel, the fluid suspending the rest is drawn off, and made to pass through a sieve into a reservoir. After the particles of the material have precipitated, the water is drawn off, and the residuum is thrown upon a large flat pan or reservoir made of bricks, where the mass is freed from its superfluous moisture by evaporation in the air, or by means of artificial heat applied beneath. It is then laid by in a damp place, for future use.

8. Before the clay, thus purified from extraneous and coarser particles, is formed into vessels, it is beaten with a stout piece of wood, until the mass has become of an equal consistence throughout, and then repeatedly cut into two pieces with a wire, and slapped together to expel the air. The former of these operations is called *wedging*, and the latter *slapping*.

9. *White and cream-coloured wares* are made of clays which contain so little oxyde of iron that it does not turn red in burning, but, on the contrary, improves in whiteness in the furnace. There are several species of white clay, found in many different localities, most of which, however, are known under the denomination of *pipe-clay;* or they are distinguished by the names of the places where they are obtained.

10. In preparing these clays for use, they are reduced to a minute division by machinery, and afterwards dissolved in water, and otherwise treated in a manner similar to that used for the better kinds of common wares, as described in the seventh and eighth paragraphs. For the purpose of diminishing the shrinkage in the fire, and with the view of increasing the whiteness of the ware, pulverized flint-stone is added to the clay, in the proportion of about one part of the former to five of the latter.

11. In reducing the silex to the requisite fineness, it is first brought to a red heat; and, while in this state, it is thrown into cold water, to diminish the cohesion of its parts. It is then pounded by machinery, levigated with water in a mill, sifted, mashed, and otherwise treated like the clay. The materials are mixed while in a state of thin pulp.

12. The several operations performed by the potter in converting the clay, thus prepared, into different kinds of vessels, and in completing the whole process of the manufacture of earthen ware, may be included under the following divisions, viz. throwing, turning, pressing, burning, painting and printing, and glazing. They are not, however, all used in producing and finishing vessels of every shape and quality.

13. *Throwing*. This operation is performed on a potter's wheel, which consists

of a round table, and some simple means to put it in motion. The clay having been placed on the centre of this machine, the workman communicates to the latter a rotary motion with his foot, and gives the proposed form to the material with his hands, which have been previously wet with water, to prevent them from sticking. This method is used for all vessels and parts of vessels of a circular form; and, in many cases, no other operation is necessary to give them the requisite finish, so far as their conformation is concerned.

14. *Turning*. The vessels are cut from the thrower's wheel with a small wire; and when, by the evaporation of moisture, they have become firm enough to endure the operation. they are turned on a lathe. The objects of this operation are to communicate to them a more exact shape, and to render them more uniform in thickness. The potter's wheel, with the addition of some contrivance to hold the pieces in a proper position, is frequently used for turning. The coarser kinds of common wares are never turned.

15. *Pressing*. Vessels, or parts of vessels, which are of an irregular shape, and which cannot be formed on the wheel, are usually made by a process called *pressing*. This kind of work is executed in moulds made of plaster of Paris, and these are formed on models of clay or wood, which have been made in the exact shape of the proposed vessel. Sometimes individual specimens of the wares of one country or pottery are used as models in another; in such cases, the expense of the moulds is considerably diminished.

16. The moulds frequently consist of several parts, which fit accurately together; for example, the mould for a pitcher is composed of two pieces for the sides, and one for the bottom. In forming a pitcher in such a mould, the material, which has been spread out to a proper and uniform thickness, is laid upon the inside of each portion of it, and the superfluous clay is trimmed off with a knife. The mould is then closed, and thin strips of clay are laid over the seams: the removal of the several pieces of the mould, completes the operation.

17. Handles, spouts, figures in relief, and other additions of this nature, are separately made in moulds, and stuck on the vessels with the same kind of materials, sometimes mingled with a small proportion of plaster of Paris. These appendages are added after the vessels have become partially solid in the air.

18. *Burning*. All vessels, even after they have been dried in the atmosphere, are in a very frangible state; and, to render them sufficiently firm for use, they are submitted to the process of burning in a kiln. To preserve the ware from injury while enduring the fire, the several pieces are inclosed in cylindrical boxes called *saggers*, which are made of baked clay. These boxes are placed one above another around the sides of the kiln, which is of a circular form, and gradually tapering to the top.

19. In burning the coarser wares, every piece is not thus inclosed; but between every two saggers, a naked piece is placed. A moderate fire is first raised, which is gradually increased, until the contents of the kiln are brought to a red heat. The burning occupies between twenty-four and forty-eight hours. All wares, except the coarsest kinds, are twice, and sometimes thrice, burned; and, after having been once submitted to the process, they are said to be in a state of *biscuit*.

20. *Painting and printing*. When the vessels are to be ornamented with colours,

it is necessary, in most cases, that this part of the work be done after the first burning. In China, and at the porcelain manufactory in Philadelphia, the drawings are executed by hand with a pencil: the same method is used in Europe, in elaborate pieces of workmanship. But in the common figured wares, where but one colour is used, the designs are first engraved on metallic plates, and impressions are taken from them on thin paper, by means of a copper-plate printing-press.

21. In transferring to vessels designs thus produced, the paper, while in a damp state, is applied closely to the surface of the biscuit, and rubbed on with a piece of flannel. The porosity of the earthen material causes the immediate absorption of the colouring matter, which, in all cases, is some metallic oxyde. For a blue colour, the oxyde of cobalt is used; and for a black, those of manganese and iron. The paper is washed from the ware with a sponge.

22. *Glazing.* To prevent the penetration of fluids, and to improve the appearance of the ware, a superficial vitreous coating is necessary. This can be produced by the aid of various substances; but, in a majority of cases, red lead is the basis of the mixture employed for this purpose. Equal parts of ground flints and red lead are used for the common cream-coloured wares. These materials are mixed with, and suspended in, water, and each piece is dipped in the liquid. The moisture is soon absorbed by the clay, leaving the glazing particles on the surface, which, in the burning that follows, is converted into a uniform and durable vitreous coating.

23. *Stone ware.* The materials of this ware, as well as the mode of preparing them, differ but little from those of the common and better kinds of earthen wares. The clays, however, which contain but little or no oxyde of iron are chosen, since this substance would cause the ware to melt and warp before a sufficient degree of heat could be applied to give it the requisite hardness.

24. The glazing is formed by a vitrification of the surface of the vessels, caused by the action of common salt thrown into the kiln, when it has been raised to its greatest heat. This glazing is more perfect than that on ordinary earthen wares, being insoluble in most chemical agents. It is hardly necessary to remark that this method of glazing precludes the use of saggers.

25. *Porcelain.* This ware exceeds every other kind in the delicacy of its texture, and is peculiarly distinguished by a beautiful semi-transparency, which is conspicuous when held against the light. In China, it is made chiefly of two kinds of earth; one of which is denominated *petuntze*, and the other *kaolin;* but both are varieties of felspar, found in the mountains, in different localities. They are brought to the manufactories from a distance in the form of bricks; the materials, as taken from the mines, having been reduced to an impalpable powder in mortars, either by the labour of men or by water-power.

26. These materials are combined in different proportions in the manufacture, according to the quality of the proposed ware. In the best kind, equal quantities are used; but for those of inferior quality, a greater proportion of petuntze is employed. The translucency so much admired in porcelain, or *tseki*, as the Chinese call it, is owing to the petuntze, which, in burning, partially melts, and envelopes the infusible kaolin.

27. It is not known who was the inventor of porcelain, as the Chinese annals are

silent with regard to this point; nor do we know more of the date at which the manufacture was commenced. It is certain, however, that it must have been before the fifth century of the Christian era. Since this ware has been known to Europeans, it has been manufactured chiefly, and in the greatest perfection, in the large and populous village of King-te-ching.

28. Porcelain was first brought to Europe from Japan and China, and for a long time its materials and mode of manufacture remained a secret, in spite of the efforts of the Jesuit missionaries, who resided in those countries. At length, in 1712, father Entrecolles sent home to France, specimens of petuntze and kaolin, together with a summary description of the process of the manufacture.

29. Shortly after this important event had transpired, it was discovered that materials nearly of the same kind existed in abundance in various parts of Europe. The manufacture of porcelain was, therefore, soon commenced in several places; and it has since been successfully carried on.

30. The porcelain wares of Europe are superior to those of the Chinese, in the variety and elegance of their forms, as well as in the beauty of the designs executed upon them; but as some of the processes, successfully practised in China, remain still to be learned by the Europeans, the oriental porcelain has not yet been equalled in the hardness, strength, and durability of its body, and in the permanency of its glaze. The manufacturers of Saxony are said to have been the most successful in their imitations in these respects.

31. The porcelain earths are found in various parts of the United States, but particularly at Wilmington, in the state of Delaware. Nevertheless, there is now *but one porcelain manufactory* in our country, and this is yet in its infancy. The establishment is located in Philadelphia, and it has been lately incorporated, with the privilege of one hundred thousand dollars capital.

32. The principle of induration by heat, is the same in the manufacture of earthen wares as in making bricks; and as the latter can be more easily dispensed with than the former in a primitive state of society, it is but reasonable to suppose that earthen ware was first invented: but the art of making bricks must have been practised before the deluge, or the posterity of Noah would not have attempted so soon as about one hundred years after that catastrophe, to build a city and a tower of these materials. It is, therefore, evident that this art was of antediluvian origin; and it was probably one of the earliest brought to any degree of perfection.

33. The art of the potter was practised more or less by every nation of antiquity, and the degree of perfection to which it was carried in every country corresponded with the state of the arts generally. The Greeks were consequently very celebrated for their earthen wares. The Etruscans have also been particularly noted for their manufacture of the elegant vases which have been dug, in modern times, from the depositories of the dead, in Lower Italy.

34. Until the commencement of the manufacture of porcelain in Europe, this art continued in a very rude condition, although practised to a considerable extent in many places. It was much improved in England about the year 1720, by the addition of flints to the usual material; and, between thirty and forty years after this, it was brought to great perfection, in all its branches, chiefly through the scientific exertions of the celebrated potter, Josiah Wedgewood.

GLASS BLOWER.

THE GLASS-BLOWER.

1. Glass is a substance produced from a combination of silicious earths with alkalies, and, in many cases, with metallic oxides. The basis of every species of glass is silex, which is found in a state nearly pure in the sands of many situations. It is also found in the common flints and quartz pebbles.

2. When quartz pebbles or flints are employed, they must be first reduced to powder. This is done by grinding them in a mill, after they have been partially reduced, by heating them in the fire, and plunging them into cold water. Sand has the advantage of being already in a state of division sufficiently minute for the purpose. To prepare it for application, it only requires to be washed and sifted, in order to free it from the argillaceous and other substances unfit for use. A great proportion of the sand employed in the manufacture of the better kinds of glass in the United States, is taken from the banks of the Delaware river.

3. The alkaline substances used are potash and soda. For the finer kinds of glass, pearlash, or soda procured by decomposing sea-salt, is used; but, for the inferior sorts, impure alkalies, such as barilla, Scotch and Irish kelp, and even wood-ashes, as well as the refuse of the soap-boiler's kettle, are made to answer the purpose. Lime, borax, and common salt, are also frequently used as a flux in aid of some of the other substances just mentioned.

4. Of the metallic oxides which make a part of the materials of some glass, the deutoxide of lead, or, as it is usually denominated, red lead, is the most common

This substance is employed in making flint glass, which is rendered by it more fusible, heavy and tough, and more easy to be ground and cut, while, at the same time, it increases its brilliancy and refractive power.

5. Black oxide of manganese is also used in small quantities, with the view of rendering the glass more colourless and transparent. Common nitre produces the same effect. White arsenic is also added to the materials of this kind of glass, to promote its clearness; but if too much is used, it communicates a milky whiteness. The use of this substance in drinking vessels is not free from danger, when the glass contains so much alkali as to render any part of it soluble in acids.

6. The furnace in which the materials are melted is a large conical stack, such as is represented at the head of this article. In some cases, it is surrounded by a large chimney, which extends above the roof of the building. In the sides are several apertures, near which are placed the crucibles, or melting pots, containing the materials. The fuel is applied in an arch, which is considerably lower than the surface of the ground on which the operators stand, while at work.

7. The melting pots are made chiefly of the most refractory clays and sand. Much of the clay used for this purpose, in many of the glass-houses in the United States, is imported from Germany. The materials, having been sifted, and mixed with a suitable quantity of water, the homogeneous mass is formed into crucibles, by spreading it on the inside of vessels much in the shape of a common wash tub. After the clay has become sufficiently solid to [illegible] elf, the hoops are removed [illegible] and the several staves

8. The crucibles are suffered to dry in the atmosphere for two or three months; after which they are applied to use as they may be needed. Before they are placed in the main furnace, they are gradually raised to an intense heat in one of smaller dimensions, built for this express purpose. The fuel employed in fusing the *metal* is chiefly pine wood, which, in all cases, is previously dried in a large oven. Four of the five furnaces near Philadelphia, belonging to Doctor Dyott, are heated with rosin.

9. The materials having been mixed, in the proposed proportions, which are determined by weight, they are thrown into the melting pots, and, by a gradually increasing heat, reduced to a paste, suitable for application by the blower. This part of the process is commonly performed at night, while the blowers are absent from the works.

10. The applications of glass are so exceedingly extensive, that it is inconvenient, if not impossible, to manufacture every species of it at one glass-house, or at one establishment. Some, therefore, confine their attention to the production of window glass, and such articles of hollow ware as may be made, with profit, from the same kind of paste. Others make vials and other species of ware, employed by the druggist, apothecary, and chemist. And again, the efforts, at some factories, are confined entirely to the manufacture of flint glass, or to that of plate glass for mirrors.

11. The principal operations connected with the manufacture of different species of glass, after the paste has been prepared, may be included under the following heads: viz. blowing, casting, moulding, pressing and grinding; although all these are never performed in one and the same establishment.

12. *Blowing*. The operation of blowing is nearly or quite the same in the production of every species of glass ware, in which it is employed. The manipulations, however, connected with making different articles, are considerably varied, to suit their particular conformation. This circumstance renders it impossible for us to give more than a general outline of the process of this manufacture.

13. In the formation of window glass, the workman gathers upon the end of an iron tube a sufficient amount of the metal, which he brings to a cylindrical form by rolling it upon a cast iron or stone table. He then blows through the tube with considerable force, and thus expands the glass to the form of an inflated bladder. The inflation is assisted by the heat, which causes the air and moisture of the breath to expand with great power.

14. Whenever the glass has become too stiff, by cooling, for inflation, it is again softened by holding it in the blaze of the fuel, and the blowing is repeated, until the globe has been expanded to the requisite thinness. Another workman next receives it at the other end, upon an iron rod, called a *punt*, or *punting iron*, while the blowing iron is detached. It is now opened, and spread into a smooth sheet, by the centrifugal force acquired by the rapid whirl given to it, in the manner exhibited in the preceding cut. The sheet thus produced is of a uniform thickness, except at the centre, where the iron rod had been attached.

15. An inferior kind of window glass, the materials of which are sand, kelp, and soap-boilers' waste, is made by blowing the *metal* into cones, about a foot in diameter at their base; and these, while hot, are touched on one side with a cold iron dipped in water. This produces a crack, which runs through the whole length of the cone. The glass then expands into a sheet somewhat resembling a fan. This is supposed to be the oldest method of manufacturing window or plate glass.

16. The window glass produced in the manner first described, is called *crown glass;* and the other, *broad glass*. But by neither of these methods can the largest panes be produced. The blowing for these differs from the methods just described, in that the material is blown into an irregular cylinder, which is immediately cut with shears on one side, while the glass is still in an elastic state. The material thus treated is laid upon a flat surface, where it expands into a uniform plate of equal thickness throughout.

17. *Casting*. Plate glass formed by the method last mentioned, is denominated *cylinder glass;* and it is used not only for windows, but also for mirrors not exceeding four feet in length. Plates of greater dimensions are produced by a process called *casting*. The casting is performed by pouring the material, in a high state of fusion, upon a table of polished copper of large size, and having a rim elevated above its general surface, as high as the proposed plate. To spread the glass perfectly, and to render the two surfaces parallel, a heavy roller of polished copper, resting upon the rim at the edges, is passed over it.

18. Plates thus cast are always dull and uneven. To render them good reflectors, it is necessary to grind and polish them. The plate to be polished is first cemented, with plaster of Paris, to a table of wood or stone. A quantity of wet sand, emory, or pulverized flints, is spread upon it, and another glass plate, similarly cemented to a wooden or stone surface, is placed upon it. The two plates are then rubbed together,

[illegible]

[illegible] of proper diameter and depth.

21. *Pressing.* This process is applied in the production of vessels or articles which are very thick, and which are not intended to be blown. The operation is performed in iron moulds, which consist of two parts, and which have upon their [illegible] s to be impress- [illegible] terial, while [illegible] the lower [illegible] and the other part. [illegible] is immediately brought [illegible] with considerable force.

22. Every species of glass, before it can be used with safety, must be *annealed*, to diminish its brittleness. The annealing consists merely in letting down the temperature by degrees. Small boys, therefore, convey the articles, whatever they may be, as fast as they are made, to a moderately heated oven, which, when filled, is suffered to cool by degrees.

23. *Cutting.* The name of *cut glass* is given to the kind which is ground and polished in figures, appearing as if cut with a sharp instrument. This operation is confined chiefly to flint glass, which, being more tough and soft than the other kinds, is more easily wrought. In addition to this, it is considerably more brilliant, producing specimens of greater lustre.

24. An establishment for grinding glass contains a great number of wheels of cast iron, stone, and wood, of different sizes; and the process consists entirely in holding the glass against these, while they are revolving with rapidity. When a considerable portion of the material is to be removed, the grinding is commonly commenced on the iron wheel, on which is constantly pouring water and sharp sand, from a vessel above, which, from its shape, is called a *hopper*.

25. The period of the invention of glass is quite unknown; but the following is the usual story of its origin. Some merchants, driven by a storm upon the coasts of Phœnicia, near the river Belus, kindled a fire on the sand to cook their victuals, using as fuel some weeds which grew near. The ashes produced by the incineration of these plants, coming in contact with the sand, united with its particles, and, by the influence of the heat, produced glass.

26. This production was accidentally picked up by a Tyrian merchant, who, from its beauty and probable utility, was led to investigate the causes of its formation; and who, after many attempts, succeeded in the manufacture of glass. The legend probably originated in the fact, that glass was very anciently made at Tyre; and that the sand on the sea-shore in the immediate neighbourhood of the Belus, was well adapted to glass-making.

27. It is certainly probable that an accidental vitrification might have given rise to the discovery; but the circumstance would have been more likely to take place in some operation requiring greater heat than that necessary for dressing food in the open air. The invention of glass must have been effected as early as fifteen hundred years before our era. It was manufactured very anciently in Egypt; but whether that country or Phœnicia is entitled to the preference, as regards priority in the practice of this art, cannot be determined.

28. Glass was made in considerable perfection at Alexandria, and was thence supplied to the Romans as late as the first quarter of the second century. Before this time, however, Rome had her glass manufactories, to which a particular street was assigned. The attention of the workmen was directed chiefly to the production of bottles and ornamental vases; specimens of which still remain, as monuments of their extraordinary skill.

29. In more modern times, the manufacture of glass was confined principally to Italy and Germany. Venice became particularly celebrated for the beauty of the material, and the skill of its workmen; and as early as the thirteenth century, it supplied the greatest part of the glass used in Europe. The artists of Bohemia, also, came to be held in considerable reputation.

30. The art was first practised in England in the year 1557, when a manufactory was erected at Crutched Friars, in the city of London; and shortly afterwards, another at the Savoy in the Strand. In these establishments, however, were made little else than common window-glass, and coarse bottles; all the finer articles being still imported from Venice. In 1673, the celebrated Duke of Buckingham brought workmen from Italy, and established a manufactory for casting plate-glass for mirrors and coach-windows. The art in all its branches is now extensively practised in great perfection, not only in Great Britain, but in many of the other kingdoms of Europe.

31. Before the commencement of the late war with England, very little, if any, glass was manufactured in the United States, except the most common window-glass, and the most ordinary kinds of hollow-ware. Apothecaries' vials and bottles, as well as every other variety of the better kinds of glass-wares, had been imported from Europe, and chiefly from England.

32. Our necessities, created by the event just mentioned, soon produced several manufactories, which, however, did not soon become flourishing; owing, at first, to inexperience, and, after the peace, to excessive importations. But adequate protection having been extended to this branch of our national industry, by the tariff of 1828, it is now in a highly prosperous condition—so much so, that importations of glass-ware have nearly ceased.

THE OPTICIAN.

1. The word optician is applicable to persons who are particularly skilled in the science of vision; but especially to those who devote their attention to the manufacture of optical instruments; such as—the spectacles, the camera obscura, the magic lantern, the telescope, the microscope, and the quadrant.

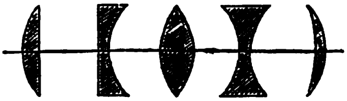
2. Light is an emanation from the sun and other luminous bodies; and is that substance which renders opaque bodies visible to the eye. It diverges in a direct line, unless interrupted by some obstacle, and its motion has been estimated at *two hundred thousand miles* in a second.

3. A *ray of light* is the motion of a single particle; and a parcel of rays passing *from a single point is called a pencil of rays. Parallel rays* are such as always move at the same distance from each other. Rays which continually approach each other are said to *converge;* and when they continually recede from each other, they are said to *diverge.* The point at which converging rays meet is called the *focus.*

4. Any pellucid or transparent body, as air, water, and glass, which admits the free passage of light, is called a *medium.* When rays, after having passed through one medium, are bent out of their original course by entering another of different density, they are said to be *refracted;* and when they strike against a surface, and are sent back from it, they are said to be *reflected.*

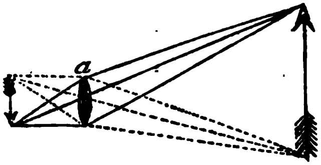
5. A *lens* is glass ground in such a form as to collect or disperse the rays of light

which pass through it. These are of different shapes; and they have, therefore, received different appellations. A *plano-convex* lens has one side flat, and the other convex: a *plano-concave* lens is flat on one side, and concave on the other: a *double convex* lens is convex on both sides: a *double concave* lens is concave on both sides: a *meniscus* is convex on one side, and concave on the other. By the following cut, the lenses are exhibited in the order in which they have been mentioned.



6. An *incident ray* is that which comes from any luminous body to a reflecting surface; and that which is sent back from a reflecting surface is called a *reflected ray*. The *angle of incidence* is the angle which is formed by the incident ray with a perpendicular to the reflecting surface; and the *angle of reflection* is the angle formed by the same perpendicular and the reflected ray.

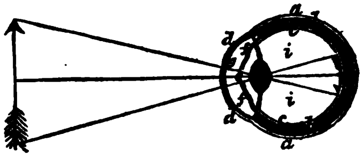
7. When the light proceeding from every point of an object placed before a lens is collected in corresponding points behind it, a perfect image of the object is there produced. The following cut is given by way of illustration.



8. The lens, *a*, may be supposed to be placed in the hole of a window-shutter of a darkened room, and the arrow at the right to be *standing* at some distance without. All the light reflected from the latter object towards the lens, passes through it, and concentrates, within the room, in a focal point; at which, if a sheet of paper, or any other plane of a similar colour, be placed, the image of the object will be seen upon it.

9. This phenomenon is called the *camera obscura*, or dark chamber, because it is necessary to darken the room to exhibit it. The image at the focal point within the room is in an inverted position. The reason why it is thrown in this manner will be readily understood by observing the direction of the reflected rays, as they pass from the object through the lens. In the camera obscura, it is customary to place a small mirror immediately behind the lens, so as to throw all the light which enters, downwards upon a whitened table, where the picture may be conveniently contemplated.

10. From the preceding explanation of the camera obscura, the theory of vision may be readily comprehended, since the eye itself is a perfect instrument of this kind. A careful examination of the following representation of the eye will render the similarity obvious. The eye is supposed to be cut through the middle, from above downwards.



a a, the *sclerotica*; *b b*, the *choroides*; *c c*, the *retina*; *d d*, the *cornea*; *e*, the *pupil*; *f f*, the *iris*; *g*, the *aqueous humour*; *h*, the *crystalline humour*; *i i*, the *vitreous humour*.

11. The *sclerotica* is a membranous coat, to which the muscles are attached which move the eye. The cornea is united to the sclerotica around the circular open-

[illegible] distance at [illegible] seen, [illegible] nine [illegible] persons. [illegible] considerably [illegible] former [illegible]

[illegible]

[illegible]

[illegible] degree, [illegible] found [illegible] render [illegible] enable the ed from them, which causes the rays to reach the retina before they have converged to a focus. This defect is remedied by convex lenses, which bring the visual point nearer to the eye, and consequently cause the rays to concentrate in a large focus upon the retina. The most powerful microscopic lenses are small globules of glass, which permit the eye to be brought very near to the object.

20. *Microscopes* are either *single* or *double*. In the former case, but one lens is used, and through this the object is viewed directly; but, in the latter case, two or more glasses are employed, through one of which a magnified image is thrown upon a reflecting surface, and this is viewed through the other glass, or glasses, as the real object is seen through a single microscope.

21. The *solar microscope*, on account of its great magnifying powers, is the most wonderful instrument of this kind. The principles of its construction are the same with those of the camera obscura. The difference consists chiefly in the minor circumstance of placing the object very near the lens, by which a magnified image is thrown at the focal point within the room.

22. In the case of the camera obscura, the objects are at a far greater distance from the glass on the outside, than the images, at the focal point, on the inside. The comparatively great distance of the object, in this case, causes the image to be proportionably smaller. In the solar microscope, a small mirror is used to receive the rays, and to reflect them directly upon the object.

23. The *magic lantern* is an instrument used for magnifying paintings on glass, and for throwing their images upon a white surface in a darkened room. Its general construction is the same with that of the solar microscope; but in the application, the light of a lamp is employed instead of that from the sun.

24. *Telescopes* are employed for viewing objects which from their distances appear small, or are invisible to the naked eye. They are of two kinds—*refracting* and *reflecting*. The former kind is a compound of the camera obscura and the single microscope. It consists of a tube, having at the further end a double convex lens, which concentrates the rays at a focal point within, where the image is viewed through a microscopic lens, placed at the other end.

25. In the construction of reflecting telescopes, concave mirrors or specula are combined with a double convex lens. A large mirror of this kind is so placed in the tube that it receives the rays of light from objects, and reflects them upon another of a smaller size. From this they are thrown to a focal point, where the image is viewed through a double convex lens. The specula are made of speculum metal, which is a composition of certain proportions of copper and tin.

26. Many optical appearances are of so frequent recurrence that they could not have escaped the earliest observers; nevertheless, ages appear to have elapsed before any progress was made towards an explanation of them. Empedocles, a Greek philosopher, born at Agrigentum in Sicily, 460 years before Christ, is the first person on record who attempted to write systematically on light.

27. The subject was successively treated by several other philosophers; but the ancients never attained to a high degree of information upon it. We have reason to believe, however, that convex lenses were, in some cases, used as magnifiers.

and as burning-glasses; although the theory of their refractive power was not understood.

28. The magnifying power of glasses, and some other optical phenomena, were largely treated by Alhazen, an Arabian philosopher, who flourished about the year 1100 of our era: and, in 1270, Vitellio, a Polander, published a treatise on optics, containing all that was valuable in Alhazen's work, digested in a better manner, and with more lucid explanations of various phenomena.

29. Roger Bacon, an English monk, who was born in 1214, and who lived to the age of seventy-eight, described very accurately the effects of convex and concave lenses, and demonstrated by actual experiment, that a small segment of a glass globe would greatly assist the sight of old persons. Concerning the actual inventor of spectacles, however, we have no certain information; we only know, that these useful instruments were generally known in Europe about the beginning of the fourteenth century.

30. In the year 1575, Maurolicus, a teacher of mathematics at Messina, published a treatise on optics, in which he demonstrated that the crystalline humour of the eye is a lens, which collects the rays of light from external objects, and throws them upon the retina. Having arrived at a knowledge of these facts, he was enabled to assign the reasons why some people were short-sighted, and others long-sighted.

31. John Baptista Porta, of Naples, was contemporary with Maurolicus. He invented the camera obscura, and his experiments with this instrument convinced him that light was a substance, and that its reception into the eye produced vision. These discoveries corresponded very nearly with those by Maurolicus, although neither of these philosophers had any knowledge of what the other had done. The importance of Porta's discoveries will be evident, when it is observed, that, before his time, vision was supposed to be dependent on what were termed *visual rays*, proceeding from the eye.

32. The telescope was invented towards the latter end of the sixteenth century. Of this, as of many other valuable inventions, accident furnished the first hint. It is said that the children of Zacharias Jansen, a spectacle-maker of Middleburg, in Holland, while playing with spectacle-glasses in their father's shop, perceived that, when the glasses were held at a certain distance from each other, the dial of the clock appeared greatly magnified, but in an inverted position.

33. This incident suggested to their father the idea of adjusting two of these glasses on a board, so as to move them at pleasure. Two such glasses inclosed in a tube completed the invention of the simplest kind of the refracting telescope. Galileo greatly improved the telescope, and constructed one that magnified thirty-three times, and with this he made the astronomical discoveries which have immortalized his name.

34. John Kepler, a great mathematician and astronomer, who was born at Weir, in Wurtemburg, in the year 1571, paid great attention to the phenomena of light and vision. He was the first who demonstrated that the degree of refraction suffered by light in passing through lenses, corresponds with the diameter of the circle of which the concavity or convexity is the portion of an arch. He very successfully pursued the discoveries of Maurolicus and Porta, and asserted, that the images of external objects were formed upon the

optic nerve by the concentration of rays which proceed from them.

35. In 1625, the curious discovery of Scheiner was published at Rome, which placed beyond doubt the fact, that vision depends upon the formation of the image of objects upon the retina. The fact was demonstrated by cutting away, at the back part, the two outside coats of the eye of an animal, and by presenting different objects before it: the images were distinctly seen painted on the naked retina.

36. Near the middle of the seventeenth century, the velocity of light was discovered by Roemer; and, in 1663, James Gregory, a celebrated Scotch mathematician, published the first proposal for a reflecting telescope. But as he possessed no mechanical dexterity himself, and as he could find no workman capable of executing his designs, he never succeeded in carrying his conceptions into effect. This was reserved for Sir Isaac Newton; who, being remarkable for manual skill, executed two instruments of this kind, in the year 1672, on a plan, however, somewhat different from that proposed by Gregory.

37. In the course of the year 1666, the attention of Sir Isaac Newton was drawn to the phenomena of the refraction of light through the prism; and having observed a certain surprising fact, he instituted a variety of experiments, by which he was brought to the conclusion, that light was not a homogeneous substance; but that it is composed of particles, which are capable of different degrees of refrangibility.

38. By the same experiments, he also proved, that the rays or particles of light differ from each other in exhibiting different colours; some producing the colour red, others that of yellow, blue, &c. He applied his principles to the explanation of most of the phenomena of nature, where light and colour are concerned; and almost every thing which we know upon these subjects was laid open by his experiments.

39. The splendour of Sir Isaac Newton's discoveries obscures, in some measure, the merits of earlier and subsequent philosophers; yet several interesting discoveries in regard to light and colour, as well as many important improvements of optical instruments, have been made since his time; although the light by which these have been achieved has been derived principally from his labours.

THE GOLDBEATER, AND THE JEWELLER.

GOLD.

1. The metals most extensively employed in the arts are gold, silver, copper, lead, tin, and iron. These are sometimes found uncombined with any other substance, or combined only with each other: in either of these cases, they are said to be in a *native state*. But they are more frequently found united with some substances which, in a great measure, disguise their metallic qualities; or, in other words, in a state of ore. The mode of separating the metals from their ores, will be noticed in connexion with some of the trades in which they are prepared for, or practically applied in, the arts.

metal of a yellow colour,—
which it is distinguish-
ple metallic bodies. As a representative of property, it has been used from time immemorial; and, before coinage was invented, it passed for money in its native state. In this form, gold is still current in some parts of Africa; and even in the Southern States of our own country, in the vicinity of the gold mines, the same practice prevails in a measure.

3. Gold is rarely employed in a state of perfect purity, but is generally used in combination with some other metal, which renders it harder, and consequently more capable of enduring the friction to which it is exposed. The metal used for this purpose is called an *alloy*, and generally consists of silver or copper.

4. For convenience in commerce, this precious metal is supposed to be divided into twenty-four equal parts, called *carats*.

If perfectly pure, it is denominated gold 24 carats fine; if alloyed with one part of any other metal or mixture of metals, it is said to be 23 carats fine. The standard gold coin of the United States and Great Britain is 22 carats fine; or, in other words, it contains one-twelfth part of alloy. Gold, made standard by equal parts of copper and silver, approaches in colour more nearly to pure gold than when alloyed in any other manner.

5. Gold is found in veins in mountains, most usually associated with ores of silver, sulphurets of iron, copper, lead, and other metals. It is often so minutely distributed, that its presence is detected only by pounding and washing the ores in which it exists. But the greatest part of the gold in the possession of mankind, has been found in the form of grains and small detached masses, amid the sands of rivers and in alluvial lands, where it had been deposited by means of water, which had detached it from its original position in the mountains.

6. To separate or extract gold from the foreign matters with which it may be combined, the whole is first pounded fine, and then washed by putting it in a stream of water, which carries off the stony particles, while the gold, by its specific gravity, sinks to the bottom. To render the separation still more perfect, this sediment is mixed with ten times its weight of quicksilver, and put into a leather bag, in which it is submitted to a pressure that forces the fluid part through its pores; while the more solid part of the amalgam, which contains most of the gold, remains.

7. To separate the quicksilver from the gold, the mass is subjected to the process of *sublimation* in earthen retorts, which, as applied to metals, is similar in its effects to distillation, as applied to liquids. When gold is contained in the ores of other metals, they are roasted, in order to drive off the volatile parts, and to oxidize the other metals. The gold is then extracted by amalgamation, by liquefaction with lead, by the aid of nitric acid, or by other methods adapted to the nature of the ore.

8. Gold obtained in any of these methods is always more or less alloyed with some other metal, especially with silver or copper; but a separation is produced, so far as it is required for the purposes of commerce, by two processes, one of which is called *cupellation*, and the other *parting*. The former of these operations consists in melting the gold with a quantity of lead, which readily oxidizes and vitrifies, and which causes the same changes to take place in the metal to be detached from the mass of gold. The operation is called cupellation, because it is usually performed on a *cupel*, a vessel formed of bone-ashes, or sometimes of wood-ashes.

9. Cupellation is effectual in removing copper, but not so with regard to silver: the latter is separated by means of a process called *parting*. The metal is rolled out into thin sheets or strips, and cut into small pieces. These are put into diluted nitric acid, which, by the aid of a moderate heat, dissolves the silver, leaving the gold in a porous state.

10. Another process, called *cementation*, is also sometimes used. It is performed by beating the alloyed metal into thin plates, and arranging them in alternate layers with a cement containing nitrate of potash and sulphate of iron. The whole is then exposed to heat, until a great part of the baser metals has been removed by the action of the nitric acid liberated by the nitre. Cementation is often employed by goldsmiths to refine the surface of articles in which the gold has been com-

bined, in too small a proportion, with metals of less value.

11. The average amount of gold annually obtained in every part of the globe cannot fall far short of twenty-five millions of dollars in value: of which South America supplies about one half, and Europe about one twenty-fifth part. The amount yielded by the Southern States of our Union cannot be accurately ascertained, but the whole sum coined at the United States' Mint in 1834, from gold obtained in this quarter, amounted to $898,000, and since 1824, to $3,679,000. In 1824, the sum was but $5,000. Our Southern mines will probably continue to increase in productiveness.

THE GOLD-BEATER.

1. Gold, not being subject to intrinsic change by atmospheric action, or by that of common chemical agents, is extensively used in gilding various substances, either with the view of preserving them from decay, or for the purpose of embellishment. To prepare the gold for application in this manner is the business of the gold-beater.

1 2. The metal is first melted with some borax in a crucible, and formed into an ingot by pouring it into an iron mould. The mass is next hammered a little on an anvil, to increase the cohesion of its parts, and afterwards repeatedly passed between steel rollers, until it has become a riband as thin as paper.

2 3. Two ounces and a half of this riband are cut into 150 pieces of equal dimensions. These are hammered a little to make them
then interlaid with pieces of
ur inches square. The
other pieces of vellum
losed in two cases of
cket is then beaten on a marble anvil with a hammer weighing sixteen pounds, until the gold has been spread to near the size of the vellum leaves; it, in the mean time, being often turned over.

4. The gold leaves are next divided into four equal squares, with a steel knife on a leather cushion; and the 600 leaves thus produced are interlaid with a kind of leather or parchment made of the intestines of the ox, and beaten with a hammer weighing twelve pounds, until the leaves have been extended as before. They are again quartered and interlaid, and beaten with a hammer weighing six or eight pounds. 3

5. The gold having now been sufficiently extended, the packets are taken apart, and the leaves cut to a proper and uniform size, by means of a cane frame on a leather cushion. The leaves, as fast as they are trimmed, are placed in a book, the paper of which has been covered with red bole, to prevent the gold from sticking. Of the two ounces and a half of gold thus treated, only about one ounce remains in perfect leaves; which, altogether, amount to 2,000 three inches and three-eighths square. The books contain twenty-five leaves, so that one ounce of gold makes eighty books.

6. Gold extended into leaves is alloyed, in a greater or less degree, with silver or copper, or both; because, in a pure state, it would be too ductile. The newest skins will work the purest gold, and make the thinnest leaf, because they are the smoothest. The alloy varies from three to twenty-four grains to the ounce, but in general it is six, or one part of alloy to eighty of gold.

7. A kind of leaf called *party gold* is formed by the union of a thin leaf of gold and a thicker one of silver. The two are laid together, and afterwards heated and

pressed, until they have cohered. They are then beaten and otherwise treated, as in the process just described. Silver, and likewise copper, are also beaten into leaves, although they will by no means bear so great a reduction as gold. Considerable quantities of copper leaf are brought from Holland, which in commerce is known by the denomination of "Dutch leaf," or "Dutch gold."

8. The ancient Romans were not ignorant of the process of gold-beating, although they did not carry it so far as we do. Pliny informs us that they sometimes made 750 leaves four fingers square, from an ounce of gold. At Præneste was a statue of Fortune, gilt with leaves of a certain thickness; hence those beaten to the same degree of thickness were called *Prænestines*. Those of another and less degree of thickness, were called *quæstoriales*, for a similar reason.

9. The Romans began to gild the interior of their houses immediately after the destruction of Carthage. The wainscots of the Capitol were first ornamented in this manner; and afterwards it became fashionable to gild the walls and ceilings of private dwellings, as well as articles of furniture.

10. *Gold wire.* The ductility of gold is more conspicuous in wire than in leaves. The wire thus denominated is in reality silver wire covered with gold. It is formed by covering a silver rod with thick leaves of gold, and then drawing it successively through conical holes of different sizes, made in plates of steel. The wire may be reduced, in this manner, to a degree of extreme fineness, the gold being drawn out with the silver, and constituting for it a perfect coating.

11. Wire thus formed is often used in the manufacture of *gold thread*. Before it is applied in this way, it is flattened between rollers of polished steel, and then wound on yellow silk by machinery. The coating of gold on the silver wire employed in this way, does not exceed the millionth part of an inch in thickness.

THE JEWELLER.

1. The jeweller makes rings, lockets, bracelets, brooches, ear-rings, necklaces, watch-chains, and trinkets of like nature. The materials of the best quality of these ornaments are gold, pearls, and precious stones, although those of an inferior kind are often used.

2. There are several stones to which is applied the epithet *precious*, of which the following are the principal—the diamond, the ruby, the sapphire, the topaz, the chrysolyte, the beryl, the emerald, the hyacinth, the amethyst, the garnet, the tourmalin, and the opal. To these may be added rock crystal, the fine flints of pebbles, the cat's-eye, the oculus mundi or hydrophanes, the chalcedony, the moonstone, the onyx, the cornelian, the sardonyx, agates, and the Labrador-stone. These stones, together with different kinds of pearl, are also called gems or jewels.

3. The precious stones are valuable, as articles of merchandise, in proportion to their scarcity, weight, transparency, lustre, and hardness. In most of these particulars, the diamond is superior to any other; but those of the same size are not always of equal value, for all are not of the same colour or brilliancy. The very best are said to be *diamonds of the first water*. The diamond was called adamant by the ancients, although this term was not confined exclusively to this stone.

4. The weight and consequent value of the most precious stones are estimated

in carats, one of which is equal to four grains in weight, and the value of each carat is increased in proportion to the size of the stone. In England the cost of a cut diamond of the first water is thus estimated:—

1 carat is = £8
2 do. is 2 × 2 × 8 = 32
3 do. is 3 × 3 × 8 = 72
4 do. is 4 × 4 × 8 = 128

By the foregoing examples, it will be seen that the weight is multiplied by itself and the product by the price per carat, which may be some other sum, according to the general characteristics of the stone.

5. This rule, however, is not extended to diamonds of more than 20 carats in weight; nor is this or any other rule of estimate strictly adhered to in every case; nevertheless it probably comes pretty near to general usage. In the same country, a perfect ruby of 3½ carats is worth more than a diamond of equal weight. A ruby weighing one carat may be worth 10 guineas; two carats 40 guineas; three carats 150 guineas; six carats 1000 guineas. A ruby of a deep red colour, exceeding 20 carats, is called a carbuncle; and of these, 108, weighing from 100 to 200 carats each, are said to be in the throne of the Great Mogul.

6. Some of the European sovereigns have in their possession diamonds of great value, several of which were originally brought to England from India. The *Pitt or Regent diamond* was purchased in India by Robert Pitt, grandfather of the Right Honourable William Pitt, for £12,500 sterling. It was brought to England in a rough state, and £5000 were there exp[illegible] cutting it; but the cuttings [illegible] worth £7000 or £8[illegible] the duke of Or[illegible] Ar[illegible]nce, at the enormous price of £135,000. Its weight is 136 carats; and before it was cut, it was as large as a common pullet's egg.

7. A celebrated diamond, in the possession of the emperor of Russia, is denominated the ***Effingham*** or ***Russian diamond.*** It was brought to England by the earl of Effingham, while governor-general of India, and sold to the empress Catharine for £90,000. It is inferior in shape to the last mentioned, but superior to it in magnitude, it weighing 193 carats. The king of England has a diamond which cost £22,000.

8. The largest diamond hitherto known was found in the island of Borneo, and it is now in the possession of the rajah of Mattan. Many years ago the governor of Batavia offered in exchange for it $150,000, and two large brigs of war with their equipments and outfit; but the rajah refused to part with the jewel, to which the Malays supposed miraculous power belonged, and which they believed to be connected with the fate of his family. The weight of this diamond is 367 carats.

9. Other jewels, belonging to different sovereigns, as well as to private persons, might be mentioned; but a sufficient number has been noticed to enable the reader to form some idea of the extravagant expenditures often made for articles of imaginary value. We will merely add that the royal family of Portugal is in possession of a stone which was formerly supposed to be a diamond, but which has lately been proved to be some kind of crystal of little value. The weight of this stone is 1680 carats; and, until its real character was discovered, it was valued at 224 millions sterling.

10. The value of precious stones was much increased in ancient times, by the absurd notion commonly entertained, that they possessed miraculous powers in pre-

venting or curing diseases, as well as in keeping off witches and evil spirits. These notions still prevail more or less in heathen nations; and many, even in countries called Christian, wear them, or something else, as amulets for the same or similar purposes.

11. *The Gem-sculptor.* Figures and letters are often cut in precious stones by the gem-engraver or gem-sculptor, whose art, according to the opinion of some writers, originated with the Babylonians; but, according to others, it had its commencement in India or Egypt. In the latter country, it was first employed in the production of hieroglyphical figures on basalt and granite rocks. This art, which is denominated lithoglyptics, or the glyptic art, was held in great estimation by the Greeks in ancient times. It arose to eminence with the other fine arts; and like them it had its zenith of perfection, was buried with them in the ruins of the Roman empire, and with them revived towards the end of the fifteenth century.

12. The productions of gem-sculpture are chiefly of two kinds. The first of these are *cameos*, which are little bas-reliefs or figures raised above the surface. They are commonly made of stones, the strata of which are of different colours, so that the figure is different in colour from the ground on which it has been raised. The other productions of this art are denominated *intaglios.* The work of these is the reverse of that first mentioned, since the figure is cut below the surface of the stone, so that they serve as seals to produce impressions in relief upon soft substances.

13. This artist performs his work by means of a lathe, with the aid of diamond dust. The instruments are made of soft iron, and are fixed in leaden chucks, which can be readily fastened to one end of the mandrel. The diamond dust is made into thin paste with olive oil, and is applied to the point of the instrument. The small invisible particles insinuate themselves into the iron, where they remain permanently fixed. In producing figures and letters with a tool thus charged with the hardest substance in nature, the precious stone is brought in contact with it while in rapid motion.

14. The engraved gems of antiquity have been greatly esteemed, as works of art, by the curious, and various methods have, therefore, been devised to imitate them. This has been done in glass in such perfection, both as to form and colour, that good judges can scarcely distinguish the imitations from the originals. The impression of the gem is first taken in some kind of fine earth; and, upon the mould thus formed, the proposed material is pressed, while in a plastic state.

15. The precious stones generally have likewise been imitated with great success. The basis of the different compositions is a *paste* made of the finest flint glass, the materials of which have been selected and combined with great care. The desired colour is produced with metallic oxydes. A great number of complex receipts are in use among manufacturers of these articles.

16. *The Lapidary.* The precious stones and imitations of them in glass are brought to the desired form by the lapidary. The instrument with which this artist chiefly operates is a wheel which is made to revolve horizontally before him. It is put in motion by means of an endless rope extending from another wheel, which is moved with the left hand of the operator, while, with his right, he holds in a proper position the substance to be reduced.

17. The precious stones, being of small size, cannot be held with steadiness on the wheel with the hand, nor with any holding instrument: they are, therefore, first fastened, by means of sealing-wax, to the end of small sticks. By this simple means, and a small upright post, against which the hand or the other end of the stick is rested, the workman can hold a stone in any position he may desire.

18. The lapidary's wheel is made of different kinds of metals. The diamond is cut on a wheel of soft steel, by the aid of its own dust mixed with olive-oil. The oriental ruby, sapphire, and topaz, are cut on a copper wheel in the same manner, and polished with tripoli and water. Stones of a less degree of hardness are cut and polished on a leaden or tin wheel with emory and rotten stone.

19. The ancients were not acquainted with any method of cutting the diamond, although they applied its powder to polishing, cutting, and engraving other stones. Gems of this kind, either rough, or polished by nature, were set as ornaments, and were valued according to the beauty and perfection of their crystallization and transparency. The value of any precious stone or jewel depends much upon the skill of the lapidary.

20. *The Pearl-fisherman.*—Pearls are obtained from a testaceous fish of the oyster kind, found in the waters of the East and West Indies, as well as in other seas of different latitudes. These oysters grow in some parts of the globe, in clusters, on rocks in the depths of the sea. Such places are called *pearl-banks*, of which the most celebrated are near the islands of Ceylon and Japan, and in the Persian Gulf. [illegible] nd most costly pearls are the [illegible] considered by some to be morbid concretions or calculi, produced by the endeavour of the animal to fill up the holes which may have been made from without by small worms. Others suppose them to be mere concretions of the animal juice about some extraneous matter which may have been intruded by some means into the shell.

22. To collect the shells containing these singular productions, is the business of *divers*, who have been brought up to this dangerous occupation. They must generally descend from eight to twelve fathoms, and must remain beneath the surface of the water for several minutes, during which time they are exposed to the attacks of the voracious shark. In addition to the danger from this cause, the employment is very destructive of health.

23. In preparing a diver for his descent, a rope is tied round the body, and a stone weighing twenty or thirty pounds is fastened to the foot to sink him. His ears and nostrils are filled with cotton, and a sponge dipped in oil is fastened to his arm, to which he may now and then apply his mouth, in order to breathe without inhaling water. In addition to these equipments, he is furnished with a knife, with which the shells may be detached from the rocks, and with a net or basket, in which they may be deposited.

24. Thus equipped, he descends to the bottom, and having filled his depository, or having stayed below as long as he may be able, he unlooses the stone, gives the signal to his companions above, who quickly draw him into the boat. At some pearl-fisheries, the diving-bell is employed, which in some degree obviates some of the dangers before stated.

25. The shells thus obtained are laid by, until the body of the animal has putrified, when they commonly open of themselves.

Those which contain any pearls generally have from eight to twelve. The pearls having been dried, are assorted according to their various magnitudes; and, to effect this separation, they are passed through nine sieves of different degrees of fineness. The largest pearls are about the size of a small walnut; but such are very rare. The smallest are called ***seed pearls.***

26. Pearls are of various colours, such as white, yellow, lead-colour, blackish, and totally black. The "white water" is preferred in Europe, and the "yellow water," in Arabia and India. In regard to their form, they vary considerably; being round, pear-formed, onion-formed, and irregular. The inner part of the pearl muscle is called ***nacre*** or ***mother of pearl,*** and this is manufactured into beads, snuff-boxes, spoons, and a variety of other articles.

27. Pearls were objects of luxury among the ancients. A pearl valued by Pliny at a certain sum, which, reduced to our currency, amounts to $375,000, was dissolved by Cleopatra, and drunk to the health of Antony, at a banquet. These beautiful productions are not estimated so highly at present. The largest will sometimes command four or five hundred dollars, although very few, which are worth over forty or fifty dollars, are ever brought to this country.

28. The gem-engraver and the jeweller were both employed by Moses, in preparing the ornaments in the ephod and breastplate of the high-priest. In the former were set onyx stones, and in the latter, twelve different stones. On the gems of both ornaments, were engraved the names of the twelve tribes of Israel.

39. We, however, have evidence of the practice of the arts, connected with the production of jewelry, long before the days of the Jewish lawgiver. We learn from the twenty-fourth chapter of Genesis, that the servant of Abraham presented a golden ear-ring and bracelets for the hands, to Rebekah, who afterwards became the wife of Isaac. Perhaps these were brought from Egypt by the patriarch about seventy years before.

30. Men have ever been fond of personal ornaments, and there have been but few nations since the flood, which have not encouraged the jeweller in some way or other. In modern times, the art has been greatly improved. The French, for lightness and elegance of design, have surpassed other nations; but the English, for excellence of workmanship, have been considered, for ages, unrivalled.

31. In the United States, the manufacture of jewelry is very extensive, there being large establishments for this purpose in Philadelphia, and in Newark, N. J., as well as in several other places. So extensive have been the operations in this branch of business, and to such advantage have they been carried on, that importations from other countries have ceased, and this too, without the influence of custom-house duties.

32. The capital necessary in carrying on the business of the jeweller is considerable, inasmuch as the materials are very expensive. The operations likewise require the exercise of much ingenuity. These, however, we shall not attempt to describe, since our article on this subject has already been extended beyond its proper limits, and since, also, they could be hardly understood without actual inspection.

THE SILVERSMITH, AND THE WATCH-MAKER.

SILVER.

1. Silver is a metal of a fine white colour, and, in brilliancy, inferior to none of the metals except steel. In malleability, it is next to gold, it being capable of reduction into leaves not more than the [illegible] of an inch in thickness, and of being drawn into wire much finer than a human hair.

2. The relative value of silver and gold has varied considerably in different ages. In the prosperous period of ancient civilization, one pound of gold was worth twelve of silver. In Great Britain, the relative value of the two metals is one to fifteen and our [illegible] nd, on the continent of [illegible] ne to fifteen. In the [illegible] ative value of these [illegible] ecently established by Congress at one to sixteen. In China and Japan, it is said to be one to nine or ten.

3. There are two methods of separating silver from its various ores, and these are called *smelting* and *amalgamation*. In the former method, the ore and a due proportion of lead are heated together; and the latter, from its great affinity for silver, unites with it, and separates it from other substances. The two metals are afterwards separated from each other, by melting them on a cupel, and then exposing them to a current of atmospheric air, by which the lead is converted into an oxyde, while the silver remains untouched. This process is called *cupellation*.

4. In the other method, the first thing done is to roast the ore, to expel the sul-

phur and other volatile parts. It is then reduced to an impalpable powder, by machinery; and having been sifted, it is agitated sixteen or eighteen hours in barrels, with a quantity of quicksilver, water, and iron, combined in certain proportions. This agitation causes the several substances composing the *charge*, to unite according to their respective affinities.

5. The silver and mercury combine, forming an amalgam, which, having been put into a leather sack, a part of the latter is separated from the rest by filtration, still leaving six parts of this metal to one of the silver. The amalgam is next submitted to the action of heat in a distilling furnace, by which the mercury is sublimated.

6. The value of the silver annually taken from the mines in all parts of the world, is supposed to be about $20,000,000, of which Mexico and South America yield the greater part. The several silver mines of Europe and Asia produce about two millions and a half.

THE SILVERSMITH.

1. The artisan who forms certain articles of gold and silver is called indifferently a goldsmith or a silversmith. The former denomination is most commonly employed in England, and the latter in the United States.

2. The most common subjects of manufacture by the silversmith are, cups, goblets, chalices, tankards, spoons, knives, forks, waiters, bread-trays, tea-pots, coffee-pots, cream-pots, sugar-bowls, sugar-tongs. and pencil-cases. Many of these articles he sometimes makes of gold: this is especially the case in Europe, and some parts of Asia. In the United States, the people are commonly satisfied with the less expensive metal.

3. A great proportion of the silver used by this mechanic has been previously coined into dollars. In working these into different utensils or vessels, he first melts them in a crucible, and casts the silver into solid masses by pouring it into iron moulds; and having forged it on an anvil, he reduces it still further, and to a uniform thickness, by passing it several times between steel rollers. In giving additional explanations of the operations of the silversmith, we will describe the manner in which a plain tea-pot is manufactured.

4. In forming the body, or containing part, the plate, forged and rolled as just described, is cut into a circular form, and placed on a block of soft wood with a concave face, where it is beaten with a convex hammer until it has been brought to a form much like that of a saucer. It is then placed upon an anvil, and beaten a while with a long-necked hammer with a round flattish face.

5. It is next *raised* to the proposed form by forging it on a long slender anvil, called a *stake*, with a narrow-faced hammer, which spreads the metal perpendicularly from the bottom, or laterally, according to the position in which it may be held when brought in contact with the metal.

6. After the piece has been thus brought to the proposed form, it is *planished* all over by beating it with a small hammer on the outside, while it rests on a small steel head on the inside. During the performance of these operations, the silver is occasionally *annealed* by heating it in the fire; but it is worked while in a cold state, except in the first forging, when it is wrought while a little below red heat.

7. The several pieces which compose a tea-pot of ordinary construction amount to

about fifteen; the greater part of which are rolled and forged in the manner just described. The knob on the lid, the handle, and the spout, are sometimes cast, and at other times, the two pieces of which they are formed are cut from a plate, and brought to the proper figure by impressing them with steel dies.

8. The figures seen on the cheaper kinds of silver tea-pots, as well as on other vessels and utensils, are commonly made by passing the plates or strips between engraved steel rollers, or by stamping them with steel dies. The dies are commonly brought in sudden and violent contact with the metal by means of an iron *drop*, which is let fall from a height upon it.

9. After the several parts have been brought to the proper shape, and to the requisite finish, they are firmly united together by means of a solder composed of about three parts of silver and one of brass and copper. Before the spout and handle are soldered on, the other parts, which have been thus united into one piece, are brought to a certain degree of polish.

10. This is effected chiefly in a lathe, by holding against the piece, while in rapid motion, first a file, then a scraper, and afterwards pumice stone and Scotch stone. It is then held against a rapidly revolving brush, charged with fine brick-dust and sweet oil. The handle and spout are next soldered on. After this, the vessel is annealed, and put in *pickle*, or, in other words, into a weak solution of oil of vitriol. It is then scoured with sand and water, and the whole operation is completed by burnishing the smooth parts with
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ng this kind of work, a drawing is first made on the silver with a lead pencil. The several parts are then raised from the other side, corresponding as nearly as possible to it. The vessel or piece is then filled with, or placed upon melted cement, composed of pitch and brick-dust, and after the cement has become hard by cooling, the chaser reduces the raised parts to the form indicated by the drawing, by means of small steel punches. The roughness of surface, and frosty appearance are produced by punches indented on the end.

12. The operations of the silversmith are exceedingly various, many of which could be hardly understood from mere description. We would therefore recommend to the curious, actual inspection, assuring them that the ingenuity displayed in executing the work in the different branches of the business, is well worthy of their attention. We will merely add, that spoons, knives, and forks, are not cast, as is frequently supposed, but forged from strips of silver cut from rolled sheets.

13. The earliest historical notice of gold and silver is found in the thirteenth chapter of Genesis, where it is stated that Abraham returned to Canaan from Egypt, "rich in cattle, in silver, and in gold." This event took place about 1920 years before Christ; but little more than 400 years after the deluge. From the authority of the same book, we also learn, that during the life of this patriarch, those metals were employed as a medium of commercial intercourse, and as the materials for personal ornaments, vessels, and utensils.

14. From the preceding facts, we have reason to believe that gold and silver were known to the antediluvians; for, had not this been the case, they could hardly have been held in such estimation so early as

the time of Abraham. In short, they were probably wrought even in the days of the original progenitor of the human race, as was evidently the case with iron and copper.

THE CLOCK AND WATCH MAKER.

1. The great divisions of time, noted by uncivilized men, are those which are indicated by the changes of the moon, and the annual and diurnal revolutions of the earth: but the ingenuity of man was very early exercised in devising methods of measuring more minute periods of duration.

2. The earliest contrivance for effecting this object was the sun-dial. This instrument was known to the ancient Egyptians, Chaldeans, Chinese, and Bramins. It was likewise known to the Hebrews, at least as early as 740 years before Christ, in the days of Ahaz the king. The Greeks and the Romans borrowed it from their eastern neighbours. The first sun-dial at Rome was set up by Papirius Cursor, about 300 years before Christ. Before this period, the Romans determined the time of day by the rude method of observing the length of shadows.

3. The sun-dial, as it is now constructed, consists of a plate, divided into twelve equal parts, like the face of a clock, on which the falling of a shadow indicates the time of day. The shadow is projected by the sun, through the intervention of a rod or the edge of a *plate stile* erected on the plane of a dial. But since the dial was useful only in the clear day, another instrument was invented, which could be used at all times, in every variety of situation; and to this was given the name of *clepsydra*.

4. This instrument is supposed to have been invented in Egypt; but at what period, or by whom, is not stated. Its construction was varied, in different ages and countries, according with the particular modes of reckoning time; but the constant dropping or running of water from one vessel into another, through a small aperture, is the basis in all the forms which it has assumed. The time was indicated by the regularly increasing height of the water in the receiving vessel.

5. The clepsydra was introduced into Greece by Plato, near 400 years before Christ; and, about 200 years after this, into Rome, by Scipio Africanus. It is said that Pompey brought a valuable one from the East, and that Julius Cæsar met with one in England, by which he discovered that the summer nights were shorter there than in Italy.

6. The use which Pompey made of his instrument was to limit the length of speeches in the senate. Hence he is said, by a historian of those times, to have been the first Roman who put bridles upon eloquence. A similar use was made of the clepsydra in the courts of justice, first in Greece, and afterwards in Rome.

7. A kind of water-clock, or clepsydra, adapted to the modern divisions of time, was invented near the middle of the seventeenth century; and these were extensively used, in various parts of Europe, for a considerable time: but they are now entirely superseded by our common clocks and watches, which are far more perfect in their operation, and, in all respects, better adapted to the purposes to which they are applied.

8. The invention of the clock is concealed in the greatest obscurity. Some writers attribute it to the monks, as this instrument was used in the twelfth century, in the monasteries, to regulate the inmates in their attendance on prayers

both by night and by day. Others suppose that a knowledge of this valuable instrument was derived from the Saracens, through the intercourse arising from the crusades. Be this as it may, clocks were but little known in Europe, until the beginning of the fourteenth century.

9. Richard, abbot of St. Alban's, England, made a clock in 1326, such as had never been heard of until then. It not only indicated the course of the sun and moon, but also the ebbing and flowing of the tide. Large clocks on steeples began to be used in this century. The first of this kind is supposed to have been made and put up in Padua by Jacobus Dondi.

10. A steeple clock was set up in Buologne, in 1356; and, in 1364, Henry de Wyck, a German artist, placed one in the palace of Charles V., king of France. In 1368, three Dutchmen introduced clock-work into England, under the patronage of Edward III. Clocks began to be common both in England and on the continent, about the end of the fifteenth century.

11. The clock of Henry de Wyck is the most ancient instrument of this kind of which we have a description. The wheels were made of wrought iron, and the teeth were cut by hand. In other respects, also, it was a rude piece of mechanism, and not at all capable of keeping time with accuracy. But, rude as it was, it is not likely that it was the invention of a single individual: but that, after the first rude machine was put in motion, it received several improvements from various persons. This has, at least, been the case with all the improvements made on the clock of Henry de Wyck, to the present day.

12. The application of the pendulum to clock-work appears to have been first *de by Vincenzo Galileo*, in 1649; but the improvement was rendered completely successful, in 1656, by Christian Huygens, a Dutch philosopher. The laws of the oscillation of the pendulum were first investigated by Galileo, the great Italian philosopher, and father of the Galileo just mentioned. His attention was attracted to this subject by the swinging of a lamp, suspended from the ceiling of the cathedral, at Pisa, his native city.

13. The clocks first made were of a large size, and were placed only in public edifices. The works were, at length, reduced in their dimensions, and these useful machines were gradually introduced into private dwellings. They were finally made of a portable size, and were carried about the person. These portable clocks had, for their maintaining power, a mainspring of steel, instead of a weight, as in the case of the larger time-keepers.

14. The original pocket-watches differed but little, if at all, in the general plan of their construction, from the portable clocks just mentioned. The transition from one kind of instrument to the other was, therefore, obvious and easy; but the time of the change cannot be certainly determined. It is commonly admitted, however, that Peter Hele constructed the first watch in 1510.

15. Watches appear to have been extensively manufactured at Nuremburg, in Germany, soon after their invention, as one of the names by which they were designated, was *Nuremburg eggs*. These instruments, as well as clocks, were in common use in France in 1544, when the company of clock and watch makers of Paris was first incorporated.

16. In 1658, the spring balance was invented by Doctor Nathaniel Hooke, an English philosopher. At least, the invention is attributed to him by his countrymen.

On the continent, it is claimed for Christian Huygens. Before this improvement was made, the performance of watches was so defective, that the best of them could not be relied upon for accurate time an hour together. They were accordingly constructed so as to be wound up twice a day, and to be set occasionally.

17. After the great improvements had been effected in the clock and watch by Huygens and Hooke, several others of minor importance were successively made by different persons; but our limits do not allow us to give them a particular notice; we will only state that the repeating apparatus of both clocks and watches was invented, about the year 1676, by one Barlow, an Englishman;—that the compensation or gridiron pendulum was invented by George Graham, of London, in 1715,—and that jewels were applied to watches, to prevent friction, by one Facio, a German.

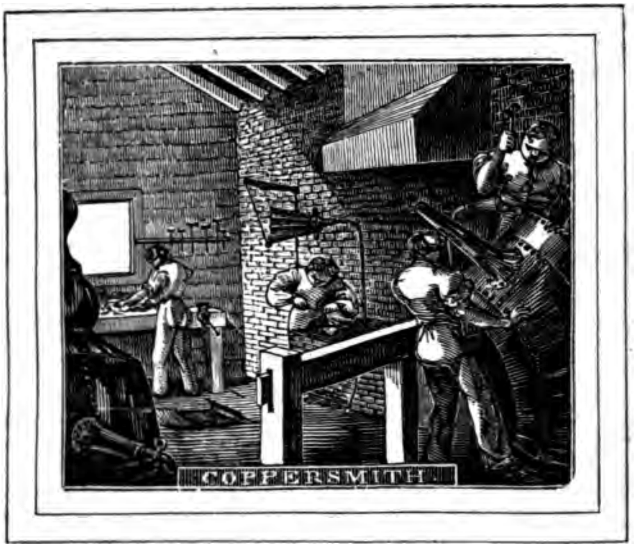
18. Clocks and watches are constructed on the same general principles. The mechanism of both is composed of wheel-work, with contrivances to put it in motion, and to regulate its movements. The moving or maintaining power in large clocks is a weight suspended by a cord to a cylinder. In watches, and sometimes in small clocks, this office is performed by a steel spring. In the clock, the regulation of the machinery is effected by the pendulum, and in the watch by the balance-wheel or spring balance. In either case, the maintaining power is prevented from expending itself except in measured portions.

19. The time is indicated by hands or pointers, which move on the dial plate. The minute hand is attached to the axle of the wheel which makes its revolution in sixty minutes, and the hour hand to the one which makes the same revolution in twelve hours. Greater and smaller divisions of time are kept and indicated on the same principle. The part of a clock which keeps the time is called the going part; and that which strikes the hour, the striking part.

20. The division of labour is particularly conspicuous in the manufacture of watches, as the production of almost every part is the labour of a distinct artisan. The workman who polishes the several parts, and puts them together, is called among this class of tradesmen the *finisher* or *watchmaker*. Those, therefore, who deal largely in watches in England, purchase the different parts from the several manufacturers, and cause them to be put together by the finisher.

21. Watches are extensively manufactured in various parts of Europe, but particularly in French Switzerland, France, and England. The London watchmakers have been celebrated for good workmanship, for more than a century and a half. This manufacture has not yet been commenced in the United States, although the machinery, or *inside* work, is very commonly imported in tin boxes, and afterwards supplied with dial plates and cases. This is especially the case with the more valuable kind of watches.

22. Brass clocks are manufactured in most of our cities, and in many of our villages; and wooden clocks, in great numbers, in the state of Connecticut. These last are carried by pedlars into the remotest parts of the country, so that almost every farmer in our land can divide the day by the oscillations of the pendulum.



THE COPPERSMITH, THE BUTTON MAKER, &c.

COPPER.

1. Copper is a ductile and malleable metal, of a pale yellowish red colour. It is sometimes found in a native state, but not in great quantities. The copper of commerce is principally extracted from the ores called sulphurets. Copper mines are wrought in many countries; but those of Sweden are said to furnish the purest copper of commerce, although those of the island of Anglesea are said to be the richest.

2. In working sulphuretted ore, it is first broken into pieces, and roasted with a moderate heat in a kiln to free it from sulphur. When the ore is also largely com- nic, a greater degree of In such a case, it is floor of a reverberatory furnace, and exposed to a greater heat. By this treatment the sulphur and arsenic are soon driven off.

3. The ore is then transferred to the fusing furnace, and smelted in contact with fuel. The specific gravity of the copper causes it to sink beneath the *scoria* into a receptacle at the bottom of the furnace. To render the metal sufficiently pure, it requires repeated fusions, and even after these, it usually contains a little lead, and a small portion of antimony.

4. *Alloys of copper.* Copper is combined by fusion with a great number of metals, and in such combinations, it is of great importance in the arts. When added in small quantities to gold and silver, it increases their hardness without materially injuring their colour; or dimin-

ishing their malleability. An alloy, called white copper, imported from China, and denominated in that country *pakfong*, is composed of copper, zinc, nickel, and iron. It is very tough and malleable, and is easily cast, hammered, and polished. When well manufactured, it is very white, and as little liable to oxidation as silver.

5. Copper, with about one-fourth of its weight of lead, forms *pot-metal.* *Brass* is an alloy of copper and zinc. The proportion of the latter metal varies from one-eighth to one-fourth. Mixtures, chiefly of these two metals, are also employed to form a variety of gold-coloured alloys, among which are *prince's metal*, *pinchbeck*, *tombac*, and *bath metal.*

6. A series of alloys is formed by a combination of tin and copper. They are all more or less brittle, rigid, and sonorous, according to the relative proportions of the two metals; these qualities increasing with the amount of tin. The principal of these alloys are, *bronze*, employed in the casting of statues; *gun-metal*, of which pieces of artillery are made; *bell-metal*, of which bells are made; and *speculum-metal*, which is used for the mirrors of reflecting telescopes.

7. The alloys of copper were very prevalent among the nations of antiquity, and were used in many cases where iron would have answered a much better purpose. The instruments of husbandry and of war, as well as those for domestic uses generally, were usually made of bronze; a composition which furnishes the best substitute for iron and steel. The Corinthian brass, so celebrated in antiquity, was a mixture of copper, gold, and silver.

8. The earliest information of the use of this metal by mankind, is found in the fourth chapter of Genesis, in which it is stated, that, "Tubal-Cain was the instructor of every artificer in brass and iron." This individual was the seventh generation from Adam, and was born about the year of the world 500.

THE COPPERSMITH.

1. Copper, being easily wrought, is applied to many useful purposes. It is formed into sheets by heating it in a furnace, and compressing it between steel rollers. The operation of rolling constitutes a distinct business, and is performed in mills erected for the express purpose.

2. The rolled sheets are purchased according to weight by the coppersmith, who employs them in sheathing the bottoms of ships, in covering the roofs of houses, and in constructing steam-boilers and stills. He also fabricates them into a variety of household utensils, although the use of this metal in preparing and preserving food, is attended with some danger, on account of the poisonous quality of the verdigris which is produced on the surface.

3. An attempt has been made to obviate this difficulty, by lining the vessels with a thin coating of tin. This answers the purpose fully, so long as the covering of tin remains entire. But in cases of exposure to heat, it is liable to be melted off, unless it be kept covered with water.

4. This metal can be reduced, by forging, to any shape; but during the process, it will bear no heat greater than a red heat; and, as it does not admit of welding, like iron, different pieces are united with bolts or rivets of the same metal, as in the case of the larger kinds of vessels; or by means of solder made of brass and zinc, or zinc and lead, as in the case of those of smaller dimensions.

5. Brass is applied to a greater variety of purposes in the arts than copper. This

preference has arisen from its superior beauty, from the greater facility with which it can be formed into any required shape, and from its being less influenced by exposure to the ordinary chemical agents.

6. Some of the articles manufactured of brass, are forged to the required form, and others are made of rolled sheets; but, in most cases, they pass through the hands of the brassfounder, who liquifies the metal and pours it into moulds of sand. For the sake of lightness, and economy of material, many articles are made hollow; in such cases, they are cast in halves or pieces, and these are afterwards soldered together.

7. Pieces which have been cast are generally reduced in size, and brought more exactly to the proposed form either in a lathe, with tools adapted to turning, or in the vice, with files, and other suitable instruments. The operators in brass form a class of mechanics distinct from those who work in copper.

THE BUTTON MAKER.

1. Trifling as the manufacture of buttons may appear, there are few which include a greater variety of operations. The number of substances of which they are made is very great; among which are gold, silver, various alloys of copper, steel, tin, glass, mother-of-pearl, bone, horn, and tortoise-shell, besides those which consist of moulds of wood or bone, covered with silk, mohair, or with similar materials.

2. In making gilt buttons, the *blanks* or bodies are cut from rolled plates of brass, with a circular punch driven by means of a fly wheel. The blanks thus produced, are planished with a plain die, if they are *intended for plain buttons;* or with one having on it, an engraved figure, if they are to be of the ornamental kind. In either case, the die is usually driven with a fly press.

3. The shanks are next placed on one side of the proposed button, and held there temporarily with a wire clasp. A small quantity of solder and rosin having been applied to each shank, the buttons are exposed to heat on an iron plate, until the solder shall have melted. The shanks having been thus firmly soldered on, the buttons are turned off smoothly on their edges in a lathe.

4. The buttons are next freed from oxide, by immersing them in diluted nitric acid, and by friction in a lathe. They are then put into a vessel containing a quantity of nitric acid supersaturated with mercury. The superior attraction of the copper for the acid, causes a portion of it to be absorbed; and the mercury held in solution by it is deposited on the buttons, which are next put into a vessel containing an amalgam of mercury and gold.

5. The amalgam is formed by melting the two metals together, and afterwards pouring them into cold water. The composition having been put into a bag of chamois leather, and a part of the mercury pressed through the pores, the remaining portion is left in a condition approaching the consistency of butter, and in a fit state for use. Before the buttons are put into the amalgam, a small quantity of nitric acid is added.

6. The buttons having been covered with the amalgam, as before stated, the mercury is discharged, that the gold may adhere directly to the brass. This object is effected by heating the buttons in an iron pan, until the amalgam begins to melt, when they are thrown into a large felt cap, and stirred with a brush. This operation

is repeated several times, until all the mercury has been volatilized. The whole process is finished by again burnishing them, and putting them on cards for sale.

7. White metal buttons are made of brass alloyed with different proportions of tin. They are cast, ten or twelve dozens at a time, in moulds formed in sand, by means of a pattern. The shanks are placed in the centre of the moulds, so that, when the metal is poured in, they become a part of the buttons. The buttons are next polished in a lathe, with grindstone dust and oil, rotten stone and crocus martis. They are then boiled with a quantity of grained tin, in a solution of crude red tartar or argol, and lastly, finished with finely pulverized crocus, applied with buff leather.

8. Glass buttons are made of various colours, in imitation of the opal and other precious stones. While manufacturing them, the glass is kept in a state of fusion, and a portion of it for each button is nipped off out of the crucible with a metallic mould, somewhat similar to that used for running bullets, the workman having previously inserted into it the shank.

THE PIN-MAKER.

1. There is scarcely any commodity cheaper than pins, and none which passes through the hands of a greater number of workmen in the manufacture; twenty-five persons being successively employed upon the material, before it appears in these useful articles, ready for sale.

2. The wire having been reduced to the required size, is cut into pieces long enough to make six pins. These pieces are brought to a point at each end by holding them, a handful at a time, on a grindstone. This part of the operation is performed with great rapidity, as a boy twelve years of age can sharpen 16,000 in an hour. When the wires have been thus pointed, the length of a pin is taken off at each end, by another hand. The grinding and cutting off are repeated, until the whole length has been used up.

3. The next operation is that of forming the heads, or, as the pin-makers term it, *head-spinning*. This is done with a *spinning-wheel*, by which one piece of wire is wound upon another; the former, by this means, being formed into a spiral coil similar to that of the springs in elastic suspenders. The coiled wire is cut into suitable portions with the shears, every two turns of it being designed for one head. These heads are fastened to the *lengths* by means of an instrument like a hammer, which is put in motion with the foot, while the hands are employed in taking up, adjusting, and placing the parts upon the anvil.

4. The pins are now finished, as to their form; but still they are merely brass. To give them the requisite whiteness, they are thrown into a copper vessel, containing a solution of tin and the lees of wine. After a while, the tin leaves the liquid, and fastens on the pins, which, when taken out, assume a white appearance. They are next polished by agitating them with a quantity of bran in a vessel moved in a rotary manner. The bran is separated from them, as chaff is separated from wheat.

5. Pins are also made of iron wire, and coloured black by a varnish composed of linseed oil and lamp-black. This kind is designed for persons in mourning. Pins are likewise made with a head at each end, to be used by females in adjusting the hair for the night, without the danger of pricking. Several machines have been

invented for this manufacture, one of which makes a solid head from the body of the pin itself; but the method just described still continues to be the prevailing one.

6. Pins are made of various sizes. The smallest are called minikins, the next short whites. The larger kinds are numbered from three to twenty, each size increasing one half from three to five, one from five to fourteen, and two from fourteen to twenty. They are put up in papers, according to their numbers, as we usually see them, or in papers containing all sizes. In the latter case, they are sold by the pound.

7. It is difficult, or even impossible, to trace the origin of this useful little article. It is probable, however, that it was invented in France, in the fifteenth century. One of the prohibitions of a statute, relating to the pin-makers of Paris of the sixteenth century, forbid any manufacturer to open more than one shop for the sale of his wares, except on new-year's day, and on the day previous.

8. Hence we may infer, that it was customary to give pins as new-year's presents, or that it was the usual practice to make the chief purchases at this time. At length it became a practice, in many parts of Europe, for the husband to allow to his wife a sum of money for this purpose. We see here the origin of the phrase, *pin-money*, which is now applied to designate the sum allowed to the wife for her personal expenses generally.

9. Prior to the year 1443, the art of making pins from brass wire was not known in England. Until that period, they were made of bone, ivory, or boxwood. Brass pins are first mentioned in the English statute book in 1483, when those of foreign manufacture were prohibited.

10. Although these useful implements are made in London, and in several other places in England, yet Gloucester is the principal seat of this manufacture in that kingdom. It was introduced into that place in 1626, by John Silsby, and it now contains nine distinct manufactories, in which are employed about 1500 persons, chiefly women and children. Pins are also manufactured extensively in the villages near Paris, and in several other places in France, as well as in Germany.

11. The business of making pins has been lately commenced in the city of New-York, and it is said that the experiment has been so successful, both in the perfection of the workmanship, and in the rapidity of the production, that pins of American manufacture bid fair to compete, at least, with those of foreign countries.

TIN PLATE WORKER.

THE TINPLATE WORKER, &c.

TIN.

1. Tin is a whitish metal, less elastic, and less sonorous than any other metal, except lead. It is found in the mountains which separate Galicia from Portugal, and in the mountains between Saxony and Bohemia. It also occurs in the peninsula of Molucca, in India, Mexico, and Chili. But the mines of Cornwall and Devonshire, in England, are more productive than those of all other countries united.

2. There are two ores of tin, one of which is called *tin stone*, and the other *tin pyrites;* the former of these is the kind from which the metal is extracted. The ore is usually found in veins, which often penetrate the hardest rocks. When near the surface of the earth, or at their commencement, they are very small, but they increase in size, as they penetrate the earth. The direction of these veins, or, as the miners call them, *lodes*, is usually east and west.

3. The miners follow the lode, wheresoever it may lead; and when they extend to such a depth that the waters become troublesome in the mine, as is frequently the case, they are pumped up with machinery worked by steam, or drawn off by means of a drain, called an *adit.* The latter method is generally adopted, when practicable.

4. The ore is raised to the surface through shafts, which have been sunk in a perpendicular direction upon the vein. At the top of the shaft, is placed a windlass, to draw up the *kibbuts*, or baskets, containing the ore. Near St. Austle, in

Cornwall, is a mine which has not less than fifty shafts, half of which are now in use. Some of the veins have been worked a [illegible], and some of the shafts are nearly seven hundred feet deep.

5. At St. Austle Moor, there is a mine of stream tin, about three miles in length. The tin, together with other substances, has been deposited in a valley, by means of small streams from the hills. The deposite is about twenty feet deep, and the several materials of which it is composed, have settled in strata, according to their specific gravity. The ore, being the heaviest, is of course, found at the bottom.

6. The ore, from whatever source it may be obtained, is first pulverized in a stamping mill, and then washed, to free it from the stony matter with which it may be united. The ore, thus partially freed from foreign matter, is put into a reverberatory furnace, with fuel and limestone, and heated intensely. The contents of the furnace having been brought to a state of fusion, the lime unites with the earthy matters, and flows with them into a liquid glass, while the carbon of the coal unites with the tin. The metal sinks, by its specific gravity, to the bottom of the furnace, and is let out, after having been exposed to the heat about ten hours.

7. The tin thus obtained is very impure: it therefore requires a second fusion, to render it fit for use. After having been melted a second time, it is cast into blocks weighing about three hundred pounds. These blocks are taken to places desig- d by law, and there stamped, by in- tors appointed for the purpose, by the e of Cornwall. In performing this ation, the inspector cuts off a corner, sta block at that place, with p with the name of the cautions give assurance that the metal is pure, and that the duty has been paid.

8. The duty is four shillings sterling per hundred weight, which is paid to the Duke of Cornwall, who is also Prince of Wales. The revenue from this source amounts to about thirty thousand pounds a year. The owner of the soil also receives one sixth, or one eighth of the ore as his *dish*, as the miners call it. The miners and the smelters receive certain proportions of the metal for their services.

9. Tin was procured from Britain at a very early period. The Phœnicians are said by Strabo to have passed the pillars of Hercules, now the Straits of Gibraltar, about 1200 years before Christ. But the time at which they discovered the tin islands, which they denominated *Cassiterides*, cannot be ascertained from history, although it is evident from many circumstances, that the Scilly Islands, and the western ports of Britain, were the places from which these early navigators procured the tin with which they supplied the parts of the world to which they traded.

10. For a long time, the Phœnicians and the Carthaginians enjoyed the tin trade to the exclusion of all other nations. After the destruction of Carthage by the Romans, a colony of Phocean Greeks, established at Marseilles, carried on this trade; but it came into the hands of the Romans, after the conquest of Britain by Julius Cæsar.

11. The Cornish mines furnish incontestable proofs of having been worked many hundred years ago. In digging to the depth of forty or fifty fathoms, the miners frequently meet with large timbers embedded in the ore. Tools for mining have also been found in the same, or similar situations. The mines, therefore, which had been exhausted of the ore,

have, in the course of time, been replenished by a process of nature.

12. To what purposes the ancients applied all the tin which they procured at so much labour and cost, is not precisely known. It is probable, that the Tyrians consumed a portion of it, in dyeing their purple and scarlet. It formed then, as it now does, many important alloys with copper. The mirrors of antiquity were made of a composition of these metals.

13. The method of extracting tin from its ores was probably very defective in ancient times. At least, it was so for several centuries before the time of Elizabeth, when Sir Francis Godolphin introduced great improvements in the tin works. The use of the reverbatory furnace was commenced about the beginning of the eighteenth century, and soon after, pit-coal was substituted for charcoal.

14. This metal, in its solid state, is called *block-tin.* It is applied, without admixture with any other metal, to the formation of vessels, which are not to be exposed to a temperature much above that of hot water. A kind of ware called *biddery ware*, is made of tin alloyed with a little copper. The vessels made of this composition are rendered black by the application of nitre, common salt, and sal ammoniac. *Foil* is also made by pressing it between steel rollers, or by hammering, as in the case of gold, by the gold-beaters.

15. But tin is most extensively applied as a coating to other metals, stronger than itself, and more subject to oxidation. The plates which are usually denominated tin, are thin sheets of iron coated with this metal. The iron is reduced to thin plates in a rolling-mill, and these are prepared for being tinned, by first steeping them in water acidulated with muriatic acid, and then freeing them from oxide by heating, scaling, and rolling them.

16. The tin is melted in deep oblong vessels, and kept in a state of fusion by a charcoal fire. To preserve its surface from oxidation a quantity of fat, or oil, is kept floating upon it. The plates are dipped perpendicularly into the tin, and held there for some time. When withdrawn, they are found to have acquired a bright coating of the melted metal. The dipping is performed three times for *single tin plate*, and six times for *double tin plate.* The tin penetrates the iron, and forms an alloy.

17. Various articles of iron, such as spoons, nails, bridle-bits, and small chains, are coated with tin, by immersing them in that metal, while in a state of fusion. The great affinity of tin and copper, renders it practicable to apply a thin layer of the former metal to the surface of the latter; and this is often done, as stated in the article on the coppersmith.

18. Tin and quicksilver are applied to the polished surface of glass, for the purpose of forming mirrors. In silvering plain looking-glasses, a flat, horizontal slab is used as a table. This is first covered with paper, and then with a sheet of tin foil of the size of the glass. A quantity of quicksilver is next laid on the foil, and spread over it with a roll of cloth, or with a hare's foot.

19. After as much quicksilver as the surface will hold, has been spread on, and while it is yet in a fluid state, the glass is shoved on the sheet of foil from the edge of the table, driving a part of the liquid metal before it. The glass is then placed in an inclined position, that every unnecessary portion of the quicksilver may be drained off; after which it is again laid flat upon the slab, and pressed for a con-

siderable time with heavy weights. The remaining quicksilver amalgamates with the tin, and forms a permanent, reflecting surface.

THE TIN-PLATE WORKER.

1. The materials on which the tinner, or tin-plate worker operates, are the rolled sheets of iron, coated with tin, as just described. He procures the sheets by the box, and applies them to the roofs and other parts of houses, or works them up into various utensils, such as pails, pans, bake-ovens, measures, cups, and ducts for conveying water from the roofs of houses.

2. In making the different articles, the sheets are cut into pieces of proper size, with a huge pair of shears, and these are brought to the proposed form by different tools, adapted to the purpose. The several parts are united by means of a solder made of a composition of tin and lead. The solder is melted, and made to run to any part, at the will of the workman, by means of a copper instrument, heated for the purpose, in a small furnace, with a charcoal fire.

3. On examining almost any vessel of tin ware, it will be perceived, that, where the parts are united, one of the edges, at least, and sometimes both, are turned, that the solder may be easily and advantageously applied. It will also be discovered that iron wire is applied to those parts requiring more strength than is possessed by the tin itself. The edges and handles are especially strengthened in this manner.

4. The edges of the tin were formerly turned on a steel edge, or a kind of anvil called a stock, with a mallet; and in some cases this method is still pursued, but this [illegible]rk is now more expeditiously performed, by means of several machines invented by Seth Peck, of Hartford Co., Connecticut. These machines greatly expedite the manufacture of tin wares, and they have contributed much towards reducing their price.

5. This manufacture is an extensive branch of our domestic industry; and vast quantities of tin, in the shape of various utensils, are sold in different parts of the United States, by a class of itinerant merchants, called *tin-pedlars*, who receive in payment for their goods, rags, old pewter, brass, and copper, together with feathers, hogs' bristles, and sometimes ready money.

LEAD.

1. Next to iron, lead is the most extensively diffused, and the most abundant metal. It is found in various combinations in nature, but that mineralized by sulphur is the most abundant. This ore is denominated *galena* by the mineralogists, and is the kind from which nearly all the lead of commerce is extracted.

2. The ore having been powdered, and freed, as far as possible, from stony matter, is fused either in a blast or reverberatory furnace. In the smelting, lime is used as a flux, and this combines with the sulphur and earthy matters, while the lead unites with the carbon of the fuel, and sinks to the bottom of the furnace, whence it is occasionally let out into a reservoir.

3. Lead extracted from galena, often contains a sufficient proportion of silver to render it an object to extract it. This is done by oxidizing the lead, by means of heat, and a current of air. At the end of this operation, the silver remains with a small quantity of lead, which is afterwards separated by the process of cupellation.

The oxide is applied to the purposes for which it is used, or it is reduced again to a metallic state.

4. The lead mines on the Mississippi are very productive, and very extensive. The principal mines are in the neighbourhood of Galena, in the north-western part of Illinois, and these are the richest on the globe. The lead mines in the vicinity of Potosi, Missouri, are also very productive. About 3,000,000 pounds are annually smelted in the United States.

5. Lead, on account of its easy fusibility and softness, can be readily applied to a variety of purposes. It is cast in moulds, to form weights, bullets, and other small articles. Cisterns are lined, and roofs, &c. are covered with sheet lead; and also in the construction of pumps and aqueducts, leaden pipes are considerably used. The mechanic who applies this metal to these purposes, is called a plumber.

6. Lead is cast into sheets in sand, on large tables having a high ledge on each side. The melted lead is poured out upon the surface from a box, which is made to move on rollers across the table, and is equalized, by passing over it, a straight piece of wood called a *strike*. The sheets thus formed are afterwards reduced in thickness, and spread to greater dimensions, by compressing them between steel rollers.

7. Leaden pipes may be made in various ways. They were at first formed of sheet lead, bent round a cylindrical bar, or mandrel, and then soldered; but pipes formed in this manner were liable to crack and break. The second method consists in casting successive portions of the tube in a cylindrical mould, having in it a core. As fast as the tube gets cold, it is drawn nearly out of the mould, and more lead is poured in, which unites with the tube previously formed. But pipes cast in this way are found to have imperfections, arising from flaws and air bubbles.

8. In the third method, which is the one most commonly practised, a thick tube of lead is cast upon one end of a long polished iron cylinder or mandrel of the size of the bore of the intended pipe. The lead is then reduced, and drawn out in length, either by drawing it on the mandrel through circular holes of different sizes, in a steel plate, or by rolling it between contiguous rollers, which have a semicircular groove cut round the circumference of each.

9. The fourth method consists in forcing melted lead, by means of a pump, into one end of a mould, while it is discharged in the form of a pipe, at the opposite end. Care is taken so to regulate the temperature, that the lead is chilled just before it leaves the mould.

10. *Shot* is likewise made of lead. These instruments of death are usually cast in high towers constructed for the purpose. The lead is previously alloyed with a small portion of arsenic, to increase the cohesion of its particles, and to cause it to assume more readily the globular form. It is melted at the top of the tower, and poured into a vessel perforated at the bottom with a great number of holes.

11. The lead, after running through these perforations, immediately separates into drops, which cool in falling through the height of the tower. They are received below in a reservoir of water, which breaks the fall. The shot are then proved by rolling them down a board placed in an inclined position. Those which are irregular in shape roll off at the sides, or stop, while the spherical ones continue on to the end.

THE IRON FOUNDER, &c.

IRON.

1. The properties which iron possesses, in its various forms, render it the most useful of all the metals. The toughness of *malleable iron* renders it applicable to purposes where great strength is required; while its difficult fusibility, and property of softening by heat, so as to admit of forging and welding, cause it to be easily wrought.

2. Cast iron, from its cheapness, and from the facility with which its form may changed, is made the material of nu- us structures. *Steel*, which is the important compound of iron, exceeds her metals in hardness and tenacity; ence it is particularly adapted to the ation of cutting instruments.

Ir overed, and applied to the purposes of the arts at a very early period. Tubal-Cain who was the seventh generation from Adam, "was an instructor of every artificer in brass and iron." Noah must have used much of this metal in the construction of the ark, and of course, he must have transmitted a knowledge of it to his posterity.

4. Nevertheless, the mode of separating it from the various substances with which it is usually combined, was but imperfectly understood by the ancients; and their use of it was, most likely, confined chiefly to the limited quantity found in a state nearly pure. Gold, silver, copper, and tin, are more easily reduced to a state in which they are available in the arts. They were, therefore, often used in ancient times, for purposes to which iron would have

been more applicable. This was the case especially with copper and tin.

5. Fifteen distinct kinds of iron ore, have been discovered by mineralogists; but of these, not more than four have been employed in making iron. There are, however, several varieties of the latter kind, all of which are classed by the smelters of iron under the general denomination of *bog* and *mountain*, or *hard* ores.

6. The former has much of the appearance of red, brown, or yellowish earth, and is found in beds from one to six feet thick, and in size, from one fourth of a rood to twenty acres. The mountain, or hard ore, to a superficial observer, differs but little in its appearance from common rocks or stones. It is found in regular strata in hills and mountains, or in detached masses of various sizes, in hilly land, from two to eight feet below the surface.

7. The bog ore is supposed to be a deposite from water which has passed over the hard ore. This is evidently the case in hilly countries, where both kinds occur. Some *iron-masters* use the bog; some, the hard; and others, both kinds together. In this particular, they are governed by the ore, or ores, which may exist in their vicinity.

8. The apparatus in which the ore is smelted, is called a *blast furnace*, which is a large pyramidal stack, built of hewn stone or brick, from twenty to sixty feet in height, with a cavity of a proportionate size. In shape, this cavity is near that of an egg with the largest end at the bottom, and is lined with fire brick or stone, capable of resisting an intense heat.

9. Below this cavity is placed the *hearth*, which is composed of four or five large coarse sand stones, split out of a solid rock, and chiselled, so as to suit each other exactly. These form a cavity for the reception of the iron and dross, when melted above. The hearth requires to be removed at the end of every *blast*, which is usually continued from six to ten months in succession; unless accidentally interrupted.

10. The preparation for a blast, consists principally in providing charcoal and ore. The wood for the former is cut in the winter and spring, and charred and brought to the furnace during the spring, summer, and autumn. What is not used during the time of hauling, is stocked in coal-houses, provided for the purpose.

11. The wood is charred in the following manner. It is first piled in heaps of a spherical form, and covered with leaves and dirt. The fire is applied to the wood, at the top, and when it has been sufficiently ignited, the pit is covered in; but to support combustion, several air-holes are left near the ground. The *colliers* are obliged to watch the pit night and day, lest, by the caving in of the dirt, too much air be admitted, and the wood be thereby consumed to ashes.

12. When the wood has been reduced to charcoal, the fire is partially extinguished by closing the air-holes. The coals are *drawn* from the pit with an iron-toothed rake, and while this is being performed, the dust mingles with them, and smothers the fire which may yet remain. Wood is also charred in kilns made of brick.

13. The hard ore is dug by *miners*, or, as they are commonly denominated, *ore-diggers*. In the prosecution of their labour, they sometimes follow a vein into a hill or mountain. When the ore is found in strata, or lumps, near the surface, they dig down to it. This kind of ore commonly contains sulphur and arsenic, and to free it from those substances, and to render it less compact, it is roasted in kilns, with refuse charcoal, which is too fine to be

used for any other purpose. It is then broken to a suitable fineness with a hammer, or in a crushing mill. The bog ore seldom needs any reduction.

14. Every preparation having been made, the furnace is gradually heated with charcoal, and by degrees filled to the top, when a small quantity of the ore is thrown on, and the blast is applied at the bottom, near the hearth. The blast is supplied by means of one or two cylindrical bellows, the piston of which is moved by steam or water power.

15. The coal is measured in baskets, holding about one bushel and a half; and the ore, in boxes holding about one peck. Six baskets of coal, and as many boxes of ore as the furnace can carry, is called a *half charge*, which is renewed as often as it may be necessary to keep the furnace full. With every charge is also thrown in one box of limestone.

16. The limestone is used as a flux, to aid in the fusion of the ore, and to separate its earthy portions from the iron. The iron sinks by its specific gravity, to the bottom of the hearth, and the earthy portions, now converted into glass by the action of the limestone and heat, also sink, and float upon the liquid iron. This scum, or, as it is usually culled, scoria, slag, or cinder, is occasionally removed by instruments made for the purpose.

17. When the hearth has become full of iron, the metal is let out at one corner of it, into a bed of sand, called a *pig-bed*, which is from twenty to thirty feet in length, and five or six in width. One concave channel, called *the sow*, extends the hole length of the bed, from which forty fifty smaller ones, called *pig moulds*, tend at right angles. The metal, when st in these moulds, is called *pig iron*, es of iron, *pigs*.

18. Pig iron, or *crude iron*, as it is sometimes called, being saturated with carbon and oxygen, and containing also a portion of scoria, is too brittle for any other purpose than castings. Many of these, such as stoves, grates, mill-irons, plough-irons, and kitchen utensils, are commonly manufactured at blast furnaces, and in many cases nearly all the iron is used for these purposes. In such cases, the metal is taken in a liquid state, from the hearth, in ladles.

19. In Great Britain and Ireland, and perhaps in some other parts of Europe, iron ore is smelted with *coke*, a fuel which bears the same relation to pit coal, that charcoal does to wood. It is obtained by heating or baking the coal in a sort of oven or kiln, by which it becomes charred. During the process, a sort of bituminous tar is disengaged from it, which is carefully preserved, and applied to many useful purposes.

THE IRON FOUNDER.

1. The appellation of *founder* is given to the superintendent of a blast furnace, and likewise to those persons who make castings either of iron, or any other metal. In every case, the term is qualified by a word prefixed, indicating the metal in which he operates, or the kind of castings which he may make; as, *brass*-founder, *iron*-founder, or *bell*-founder. But whatsoever may be the material in which he operates, or the kind of castings which he may produce, his work is performed on the same general principle.

2. The sand most generally employed by the founder is *loam*, which possesses a sufficient proportion of argillaceous matter, to render it moderately cohesive, when damp. The moulds are formed by burying

in the sand, wooden or metallic patterns, having the exact shape of the respective articles to be cast. To exemplify the general manner of forming moulds, we will explain the process of forming one for the *spider*, a very common kitchen utensil.

3. The pattern is laid upon a plain board, which in this application is called a *follow board*, and surrounded with a frame called a *flask*, three or four inches deep. This is filled with sand, and consolidated with rammers, and by treading it with the feet. Three wooden patterns for the legs are next buried in the sand, and a hole is made for pouring in the metal.

4. One side of the mould having been thus formed, the flask, with its contents, is turned over, and, the follow board having been removed, another flask is applied to the first, and filled with sand in the same manner. The two flasks are then taken apart, and the main pattern, together with those for the legs, removed. The whole operation is finished, by again closing the flasks.

5. The mode of proceeding in forming moulds for different articles, is varied, of course, to suit their conformation. The pattern is often composed of several pieces, and the number and form of the flasks are also varied accordingly. Cannon balls are sometimes cast in moulds of iron; and to prevent the melted metal from adhering to them, the inside is covered with pulverized black lead.

6. Rollers for flattening iron are also cast in iron moulds. This method is called *chill casting*, and has for its object the hardening of the surface of the metal, by the sudden reduction of the temperature, which takes place in consequence of the great power of the mould, as a conductor of heat. These rollers are afterwards turned in a powerful lathe.

7. Several *moulders* work together in one foundry; and, when they have completed a sufficient number of moulds, they fill them with the liquid metal. The metal for small articles is dipped from the hearth or crucible of the furnace with iron ladles, defended on every side with a thin coating of clay mortar, and poured thence into the moulds. But in casting articles requiring a great amount of iron, such as cannon, and some parts of the machinery for steam engines, the iron is transferred to the moulds in a continued stream through a channel, leading from the bottom of the crucible. In such cases, the moulds are constructed in a pit dug in the earth near the furnace. Large ladles full of iron are, in some founderies, emptied into the moulds by the aid of huge cranes.

8. Although the moulders have their distinct work to perform, yet they often assist each other in lifting heavy flasks; and in all cases, in filling the moulds. The latter operation is very labourious; but the exertion is continued but a short time, since the moulds, constructed during a whole day can be filled in ten or fifteen minutes.

9. Iron founderies are usually located in, or near, large cities, or towns, and are supplied with crude iron, or pig metal from the blast furnaces in the interior. The metal is fused either with charcoal or with pit coal. In the former case, an artificial blast is necessary to ignite the fuel; but in the latter, this object is often effected in air furnaces, which are so constructed that a sufficient current of air is obtained directly from the atmosphere.

10. The practice of making castings of iron is comparatively modern: those of the ancients were made of brass, and other alloys of copper. Until the beginning of the last century, iron was but little applied

in this way. This use of it, however, has extended so rapidly, that cast iron is now the material of almost every kind of machinery, as well as that of innumerable implements of common application. Even bridges and rail-roads have been constructed of cast-iron.

THE BAR IRON MAKER.

1. Bar iron is manufactured from pig-iron, from *blooms*, and directly from the ore; the process is consequently varied in conformity with the state of the material on which it is commenced.

2. In producing bar iron from pigs, the latter are melted in a furnace similar to a smith's forge, with a sloping cavity ten or twelve inches below, where the blast-pipe is admitted. This hearth is filled with charcoal and dross, or scoria; and upon these is laid the metal and more coal. After the coal has become well ignited, the blast is applied. The iron soon begins to melt, and as it liquefies, it runs into the cavity or hearth below: here, being out of the reach of the blast, it soon becomes solid.

3. It is then taken out, and fused again in the same manner, and afterwards a third time. After the third heat, when the iron has become solid enough to bear beating, it is slightly hammered with a sledge, to free it from the adhering scoria. It is then returned to the furnace, but being placed out of the reach of the blast, it soon becomes sufficiently compact to bear the *tilt-hammer*.

4. With this instrument, the iron is beaten, until the mass has been considerably extended, when it is cut into several ces, which, by repeated beating and g, are extended into bars, as we see *for sale.* The tilt-hammer weighs from six to twelve hundred pounds, and is most commonly moved by water power.

5. For manufacturing bar iron directly from the ore, the furnace is similar in its construction to the one just described, and the operations throughout are very similar. A fire is first made upon the hearth with charcoal; and, when the fuel has become well ignited, a quantity of ore is thrown upon it, and the ore and the fuel are renewed as occasion may require. As the iron melts, and separates from the earthy portions of the ore, it sinks to the bottom of the hearth. The scoria is let off occasionally, through holes made for the purpose. When iron enough has accumulated to make a *loop*, as the mass is called, it is taken out, and forged into bars under the tilt-hammer.

6. This way of making bar iron is denominated the *method of the Catalan forge*, and is by far the cheapest, and most expeditious. It is in general use in all the southern countries of Europe, and it is beginning to be extensively practised in the United States. When a Catalan forge is employed in making *blooms*, it is called a *bloomery*.

7. The blooms are about eighteen inches long, and four in diameter. They are formed under the tilt-hammer, and differ in substance from bar iron in nothing, except that, having been imperfectly forged, the fibres of the metal are not fully extended, nor firmly united. The blooms are manufactured in the interior of the country where wood is abundant, and sold by the ton, frequently, in the cities, to be converted into bar or sheet iron.

8. These blooms are converted into bar iron, by first heating them in an air furnace, by means of stone coal, and then passing them between chill cast iron rollers. The rollers are filled with grooves,

which gradually decrease in size from one side to the other. When the iron has passed through these, the bloom of eighteen inches in length, has become extended to nearly as many feet. The bar thus formed having been cut into four pieces, the process is finished by welding them together laterally, and again passing them between another set of rollers, by which they are brought to the form in which they are to remain.

9. Blooms are also laminated into sheets, on the same principle, between smooth rollers, which are screwed nearer to each other every time the bloom is passed between them. Very thin plates, like those which are tinned for the tin-plate-workers, are repeatedly doubled, and passed between the rollers, so that in the thinnest plates, sixteen thicknesses are rolled together, oil being interposed to prevent their cohesion. The last rollings are performed while the metal is cold.

10. Rolled plates of iron are frequently cut into rods, and narrow strips. This operation is performed by means of elevated angular rings upon rollers, which are so situated that they act reciprocally upon each other, and cut like shears. These rings are separately made, so that they can be removed for the purpose of sharpening them, when necessary. The mills in which the operations of rolling and slitting iron are performed, are called rolling and slitting mills.

THE WIRE DRAWER.

1. Iron is reduced to the form of wire by drawing rods of it through conical holes in a steel plate. To prepare the metal for the operation of drawing, it is subjected to the action of the hammer, or to that of rollers, until it has been reduced to a rod sufficiently small to be forced through the largest hole. The best wire is produced from rods formed by the method first mentioned.

2. Various machines are employed to overcome the resistance of the plate to the passage of the wire. In general, the wire is held by pincers, near the end, and as fast as it is drawn through the plate, it is wound upon a roller, by the action of a wheel and axle, or other power. Sometimes, a rack and pinion are employed for this purpose, and sometimes a lever, which acts at intervals, and which takes fresh hold of the wire every time the force is applied.

3. The finer kinds of wire are made from the larger by repeated drawings, each of which is performed through a smaller hole than the preceding. As the metal becomes stiff and hard, by the repetition of this process, it is occasionally annealed, to restore its ductility. Wire is formed of other metals by the same general method.

THE STEEL MANUFACTURER.

1. Steel is a compound of iron and carbon; and, as there are several methods by which the combination is produced, there are likewise several kinds of steel. The best steel is said to be made of Swedish or Russian bar iron.

2. The most common method of forming steel is by the process of *cementation*. The operation is performed in a conical furnace, in which are two large cases or troughs, made of fire brick, or good fire stone; and beneath these is a long grate. On the bottom of the cases is placed a layer of charcoal dust; and over this a layer of bar iron. Alternate strata of these materials are continued to a con-

siderable height, ten or twelve tons of iron being put in at once.

3. The whole is covered with clay or sand, to exclude the air, and flues are carried through the pile from the furnace below, so as to heat the contents equally and completely. The fire is kindled in the grate, and continued for eight or ten days, during which time, the troughs, with their contents, are kept red hot. The progress of the cementation is discovered by drawing a *test* bar from an aperture in the side.

4. When the conversion of the iron into steel appears to be complete, the fire is extinguished; and after having been suffered to cool for six or eight days, it is removed. Iron combined with charcoal in this manner, is denominated *blistered steel*, from the blisters which appear on its surface, and in this state, it is much used for common purposes.

5. To render this kind of steel more perfect, the bars are heated to redness, and then drawn out into bars of much smaller dimensions, by means of a hammer moved by water or steam power. This instrument is called a tilting hammer; on which account, the bars formed by it are called *tilted steel*. When the bars have been exposed to heat, and afterwards doubled, drawn out, and welded, the product is called *shear steel*.

6. But steel of cementation, however carefully made, is never quite equable in its texture; steel possessing this latter quality is made, by fusing bars of blistered steel, in a crucible placed in a wind furnace. When the fusion has been completed, the liquid metal is cast into small bars or ingots, which are known in com-
the name of *cast steel*. Cast
r, more elastic, closer in tex-
ible of receiving a higher
mon steel.

7. Steel is also made directly from cast iron, or at once from the ore. This kind is called *natural* or *German* steel, and is much inferior to that obtained by cementation. The best steel, produced directly from the ore, comes from Germany, and is made in Stiria. It is usually imported in barrels, or in chests about three feet long.

8. Steel is sometimes alloyed with other metals. A celebrated Indian steel, called *wootz*, is supposed to be carbonated iron, combined with small quantities of silicium and aluminum. Steel alloyed with a very small proportion of silver, is superior to wootz, or to the best cast steel; some other metals are also used with advantage in the same application.

9. Steel was discovered at a very early period of the world; for aught we know, long before the flood. Pliny informs us, that, in his time, the best steel came from China, and that the next best came from Parthia. A manufacture of steel existed in Sweden as early as 1340 of the Christian era, but it is generally thought that the process of converting iron into steel by cementation, originated in England at a later period. The method [illegible] making cast steel was invented at Sheffield, in the latter country, in 1750, and for a long time it was kept secret.

10. It has been but a few years since this manufacture was commenced in the United States. At present, we have fourteen steel furnaces, viz: at Boston, one; New-York, three; Troy, one; New-Jersey, two; Philadelphia, three; York Co. Pa., one; Baltimore, one; and Pittsburg, two. These furnaces together are said to be capable of yielding more than 1600 tons of steel in a year. The American steel is employed in the fabrication of agricultural utensils, and it has entirely excluded the common English blistered steel.

THE BLACKSMITH, AND THE NAILER.

THE BLACKSMITH.

1. The blacksmith operates in wrought iron and steel, and from these materials, he fabricates a great variety of articles, essential to domestic convenience, and to the arts generally.

2. This business is one of those trades essential in the rudest state of society. Even the American Indians are so sensible of its importance, that they cause to be inserted in the treaties which they make with the United States, an article stipulating for a blacksmith to be settled among them, and for a supply of iron.

3. The utility of this trade will be further manifest by the consideration, that almost every other business is carried on by its aid. The agriculturist is dependent on it for farming utensils, and mechanics and artists of every description, for the tools with which they operate: in short, we can scarcely fix upon a single utensil, vehicle, or instrument, which does not owe its origin, either directly or indirectly, to the blacksmith.

4. This business being thus extensive in its application, it cannot be presumed that any one person can be capable of executing every species of work. This, however, is not necessary; since the demand for particular articles is frequently so great, that the whole attention may be directed to the multiplication of individuals of the same kind. Some smiths make only anchors, axes, scythes, hoes, or shovels.

5. In such cases, the workmen acquire great skill and expedition in the manufacture. A tilt hammer is often used in forg-

ing large masses of iron, and even in making utensils as small as the hoe, the axe, and the sword; but the hammer which may be employed bears a due proportion in its weight to the mass of iron to be wrought. In all cases in which a tilt hammer is used, the bellows from which the blast proceeds is moved by water or steam power.

6. In the shop represented at the head of this article, sledges and hammers are used as forging instruments, and these are wielded by the workmen themselves. The head workman has hold of a piece of iron with a pair of tongs, and he, with a hammer, and two others, with each a sledge, are forging it upon an anvil. The two men are guided in their disposition of the strokes chiefly by the hammer of the master-workman.

7. In ordinary blacksmith shops, two persons commonly work at one forge; one of whom takes the lead in the operations, and the other works the bellows and uses the sledge. From the part which the latter takes in the labour, he is called the *blower* and *striker*. A man or youth, who understands but little of the business, can, in many cases, act in this capacity tolerably well.

8. The iron is rendered malleable by heating it with charcoal or with stone coal, which is ignited intensely by means of a blast from a bellows. The iron is heated more or less, according to the particular object of the workman. When he wishes to reduce it into form, he raises it to a *white heat*. The *welding heat* is less intense, and is used when two pieces are to be united by *welding*. At a red heat, and at lower temperatures, the iron is rendered more compact in its internal texture, [illegible] smooth upon its surface.

[illegible] action of the heat and air, [illegible]perature is being raised, tends to produce a rapid oxidation of the surface. This result is measurably prevented by immersing the iron in sand and common salt, which, uniting, form a vitreous coating for its protection. This coating is no inconvenience in the forging, as its fluidity causes it to escape immediately under the action of the hammer.

10. Steel is combined with iron in the manufacture of cutting instruments, and other implements, as well as articles requiring, at certain parts, a great degree of hardness. This substance possesses the remarkable property of changing its degree of hardness by the influence of certain degrees of temperature. No other substance is known to possess this property; but it is the peculiar treatment which it receives from the workman that renders it available.

11. If steel is heated to redness, and suddenly plunged into cold water, it is rendered extremely hard, but, at the same time, too brittle for use. On the other hand, if it is suffered to cool gradually, it becomes too soft and ductile. The great object of the operator is to give to the steel a quality equally distant from brittleness and ductility. The treatment by which this is effected is called *tempering*, which will be more particularly treated in the article on the cutler, whose employment is a refined branch of this business.

THE NAILER.

1. Nail-making constitutes an extensive branch of the iron business; as vast quantities of nails are annually required by all civilized communities. They are divided into two classes, the names of which indicate the particular manner in which they are manufactured; viz.—*wrought nails* and *cut nails*.

2. The former are usually forged on the

anvil, and when a finished head is required, as is commonly the case, it is hammered on the larger end, after it has been inserted into a hole of an instrument formed for the purpose. Workmen by practice acquire surprising dispatch in this business; and this circumstance has prevented the general introduction of the machines which have been invented for making nails of this description. Wrought nails can be easily distinguished from cut nails, by the indentations of the hammer which have been left upon them.

3. In making cut nails, the iron is first brought into bars between grooved rollers. The size of the bars is varied in conformity with that of the proposed nails. These bars are again heated, and passed between smooth rollers, which soon spread them into thin strips of suitable width and thickness. These strips, having been cut into pieces two or three feet in length, are heated to a red heat in a furnace, to be immediately converted into nails, when designed for those of a large size. For small nails, the iron does not require heating.

4. The end of the plate is presented to the machine, by a workman who turns the material over, first one way, and then the other, for every nail. The machine has a rapid reciprocating motion, and cuts off, at every stroke, a wedgelike piece of iron constituting a nail without a head. This is immediately caught near the head, and compressed between *gripes;* and at the same time, a force is applied to a die at the end, which spreads the iron sufficiently to form the head. From one to two hundred can be thus formed in a minute. This fact accounts for the low rate at which cut nails are now sold, which, on an average, is not more than two cents per pound above that of bar iron.

5. On account of the greater expense of manufacturing wrought nails, they are sold much higher. It is said that nine-tenths of all the nails of this kind, used in the United States, are imported from Europe. We thus depend upon foreign countries for these and many other articles, because they can be imported cheaper than we can make them; and this circumstance arises chiefly from the difference in the price of labour.

6. The first machine for making cut nails was invented in Massachusetts about thirty years ago, by a Mr. Odion, and soon afterwards another was contrived, by a Mr. Reed, of the same state. Other machines, for the same purpose, have likewise been constructed by different persons, but those by Odion and Reed are most commonly used. Before these machines were introduced, the strips of iron just described were cut into wedgelike pieces by an instrument which acted on the principle of the shears; and these were afterwards headed, one by one, with a hammer in a vice. The fact, that the manufacture of this kind of nails originated in our country, is worthy of recollection.

7. This manufacture includes also, that of tacks and spikes; but since, in the production of these, the same general methods are pursued, they need no particular notice. The different sizes of tacks are distinguished by a method which indicates the number per ounce; as two, three, or four hundred per ounce. Spikes are designated by their length in inches, and nails by the terms, two-penny, three-penny, four-penny, ten-penny, and so on up to sixty-penny.

THE CUTLER.

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1. Under the head of cutlery, is comprehended a great variety of instruments designed for cutting and penetration, and the business of fabricating them is divided into a great number of branches. Some manufacture nothing but axes; others make plane-irons and chisels; augers; saws; or carvers' tools. Others again, make smaller instruments, such as table-knives, forks, pen-knives, scissors, and ra- [illegible]. There are also cutlers who manu- [illegible] re nothing but surgical instruments.

The coarser kinds of cutlery are made [illegible] listered steel welded to iron. Tools of [illegible] etter quality are made of shear steel, [illegible] ile the sharpest and most delicate in- [illegible] formed of cast steel. The [illegible] constituting this business [illegible] in forging, tempering, and polishing; and these are performed in the order in which they are here mentioned.

3. The general method of *forging* iron and steel, in every branch of this business, is the same with that used in the common blacksmith's shop, for more ordinary purposes. The process, however, is somewhat varied, to suit the particular form of the object to be fashioned: for example; the blades and some other parts of the scissors are formed by hammering the steel upon indented surfaces called *bosses*. The bows, which receive the finger and thumb, are made by first punching a hole in the metal, and then enlarging it by the aid of a too. called a *beak-iron*.

4. The steel, after having been forged, is soft, like iron, and to give it the requi-

site degree of strength under the uses to which the tools or instruments are to be exposed, it is hardened. The process by which this is effected is called *tempering*, and the degree of hardness or strength to which the steel is brought is called its *temper*, which is required to be *higher* or *lower* according to the use which is to be made of the particular instrument.

5. In giving to the different kinds of instruments the requisite temper, they are first heated to redness, and then plunged into cold water. This, however, raises the temper too high, and, if left in this condition, they would be too brittle for use. To bring them to a proper state, they are heated to a less degree of temperature, and again plunged into cold water. The degree to which they are heated, the second time, is varied according to the hardness required. That this particular point may be perfectly understood, a few examples will be given.

6. Lancets are raised to 430 degrees Fahrenheit. The temperature is indicated by a pale colour, slightly inclined to yellow. At 450 degrees, a pale straw-colour appears, which is found suitable for the best razors and surgical instruments. At 470 degrees, a full yellow is produced, which is suitable for pen-knives, common razors, &c. At 490, a brown colour appears, which is the indication of a temper proper for shears, scissors, garden hoes, and chisels intended for cutting cold iron.

7. At 510 degrees, the brown becomes dappled with purple spots, which shows the proper heat for tempering axes, common chisels, plane-irons, &c. At 530 degrees, a purple colour is established, and this temperature is proper for table-knives and large shears. At 550 degrees, a bright blue appears, which is proper for swords and watch springs. At 560 degrees, the colour is full blue, and this is used for fine saws, augers, &c. At 600 degrees, a dark blue approaching to black settles upon the metal, and this produces the softest of all the grades of temper, which is used only for the larger kinds of saws.

8. Other methods of determining the degree of temperature at which the different kinds of cutlery are to be immersed, a second time, in cold water, are also practised. By one method, the pieces of steel are covered with tallow or oil, or put into a vessel containing one of these substances, and heated over a moderate fire. The appearance of the smoke indicates the degree of heat to which it may have been raised. A more accurate method is found in the employment of a fluid medium, the temperature of which can be regulated by a thermometer. Thus oil, which boils at 600 degrees, may be employed for this purpose, at any degree of heat which is below that number.

9. The *grinding* of cutlery is effected on cylindrical stones of various kinds, among which freestone is the most common. These are made to revolve with prodigious velocity, by means of machinery. The operation is therefore quickly performed. The *polishing* is commonly effected by using, first, a wheel of wood; then, one of pewter; and, lastly, one covered with buff leather sprinkled with an impure oxide of iron, called *colcothar* or *crocus*. The edges are set with either hones or whetstones, or with both, according to the degree of keenness required.

10. Almost every description of cutlery requires a handle of some sort; but the nature of the materials, as well as the form and mode of application, will be readily understood by a little attention to the various articles of this kind which daily fall in our way.

11. A process has been invented, by which edge tools, nails, &c., made of cast iron, may be converted into good steel. It consists in stratifying the articles with the oxide of iron, in a metallic cylinder, and then submitting the whole to a regular heat, in a furnace built for the purpose. This kind of cutlery, however, will not bear a very fine edge.

12. The sword and the knife were probably the first instruments fabricated from iron, and they still continue to be leading subjects of demand, in all parts of the world. The most celebrated swords of antiquity were made at Damascus, in Syria. These weapons never broke in the hardest conflicts, and were capable of cutting through steel armour without sustaining injury.

13. The fork, as applied in eating, is an invention comparatively modern. It appears to have had its origin in Italy, probably in the fourteenth century; but it was not introduced into England, until the reign of James the First, in the first quarter of the seventeenth. Its use was, at first, the subject of much ridicule and opposition.

14. Before the introduction of the fork, a piece of paper, or something in place of it, was commonly wrapped round some convenient projection of the piece to be carved; and, at this place, the operator placed one hand, while he used the knife with the other. The carver cut the mass of meat into slices or suitable portions, and laid them upon the large slices of bread which had been piled up near the platter, or carving dish, and which, after having been thus served, were handed about the table, as we now distribute the plates.

15. The knives used at table were pointed, that the food might be taken upon them, as upon a fork; and knives of the same shape are still common on the continent of Europe. Round-topped knives were not adopted in Paris, until after the banishment of Napoleon Bonaparte to Elba, in 1815, when every thing English became fashionable in that city.

16. In France, before the revolution of 1789, it was customary for every gentleman, when invited to dinner, to send his knife and fork before him, by a servant; or, if he had no servant, he carried them himself, in his breeches pocket. A few of the ancient regime still continue the old custom. The peasantry of the Tyrol, and of some parts of Germany and Switzerland, generally carry about them a case, containing a knife and fork, and a spoon.

17. The use of the fork, for a long time, was considered so great a luxury, that the members of many of the monastic orders were forbidden to indulge in it. The Turks and Asiatics use no forks, even to this day. The Chinese employ, instead of this instrument, two small sticks, which they hold in the same hand, between different fingers.

18. The manufacture of cutlery is carried on most extensively in England, at Birmingham, Sheffield, Walsall, Wolverhampton and London. London cutlery has the reputation of being the best, and this circumstance induces the dealers in that city, to affix the London mark to articles made at other places. In the United States, there are many establishments for the fabrication of the coarser kinds of cutlery, such as axes, plane-irons, saws, hoes, scythes, &c., but for the finer descriptions of cutting instruments, we are chiefly dependent on Europe.

THE GUN-SMITH.

1. It is the business of the gun-smith to manufacture fire-arms of the smaller sorts; such as muskets, fowling-pieces, rifles, and pistols.

2. The principal parts of the instruments fabricated by this artificer, are the barrel, the stock, and the lock. In performing the operations connected with this business, great attention is paid to the division of labour, especially in large establishments, such as those belonging to the United States, at Springfield and Harper's Ferry: for example; one set of workmen forge the barrels, ramrods, or some part of the lock; others reduce some part of the forged material to the exact form required, by means of files; and again another class of operators perform some part of the work relating to the stock.

3. The barrel is formed by forging a bar of iron into a flat piece, of proper length and thickness; and then, by turning the plate round a cylindrical rod of tempered steel, called a *mandril*, the diameter of which is considerably less than the intended bore of the barrel. The edges of the plate are made to overlap each other about half an inch, and are welded together by heating the tube in lengths of two or three inches at a time, and by hammering them with very brisk, but moderate strokes, upon an anvil which has a number of semicircular furrows upon it.

4. In constructing barrels of better workmanship, the iron is forged in smaller pieces, eight or nine inches long, and welded together laterally, as well as lengthwise. The barrel is now finished in the

usual way; or it is first made to undergo the additional operation of *twisting*,—a process employed upon those intended to be of superior quality. The operation is performed by heating small portions of it at a time, and twisting them successively, while one end is held fast.

5. The barrel is next bored with several bits, each a little larger than the preceding one. The last bit is precisely the size of the intended calibre. After the barrel has been polished, and the breech closed with a screw, its strength and soundness are tested by means of a ball of the proper size, and a charge of powder equal in weight to the ball. Pistol-barrels, which are to go in pairs, are forged in one piece, which is cut asunder, after it has been bored.

6. Barrels for rifles are much thicker than those for other small-arms: and, in addition to the boring in common barrels, they are furrowed with a number of grooves or *rifles*, which extend from one end of the cavity to the other, either in a straight or spiral direction. These rifles are supposed to prevent the rolling of the ball in its passage out, and to direct it more unerringly to the object of aim.

7. The stocks are uniformly manufactured from the wood of the walnut-tree. These are first dressed in a rough manner, usually in the country. After the wood has been properly seasoned, they are finished by workmen, who commonly confine their attention to this particular branch of the business. In each of the United States armories, is employed a machine with which the stocks are turned; and also one, with which the place for the lock is made.

8. The several pieces composing the lock are forged on anvils, some of which have indented surfaces, the more readily to give the proposed form. They are reduced somewhat with the file, and polished with substances usually employed for such purposes. The several pieces of the lock having been put together, it is fastened to the stock with screws. Other particulars in regard to the manufacture of small-arms will be readily suggested by a careful inspection of the different kinds, which are frequently met with.

9. The period at which, and the country where, gunpowder and fire-arms were first invented, cannot be certainly determined. Some attribute their invention to the Chinese; and, in confirmation of this opinion, assert that there are now cannon in China, which were made in the eightieth year of the Christian era. On this supposition, their use was gradually extended to the west, until they were finally adopted in Europe in the fourteenth century.

10. Others, however, attribute the invention of gunpowder to Berthold Schwartz, a monk, who lived at Mentz, between the years 1290 and 1320. It is said, that in some of his alchymistic experiments, he put some saltpetre, sulphur, and charcoal, into a mortar, and having accidentally dropped into it a spark of fire, the contents exploded, and threw the pestle into the air. This circumstance suggested to his mind the employment of the mixture for throwing projectiles. Some traditions, however, attribute the invention to Constantine Antlitz, of Cologne.

11. The fire-arms first used in Europe were cannon, and these were originally made of wood, wrapped in numerous folds of linen, and well secured with iron hoops. They were conical in shape, being widest at the muzzle; but this form was soon changed for the cylindrical. At length they were made of bars of iron, firmly bound together with hoops of the same

metal. In the second half of the fourteenth century, a composition of copper and tin, which was brought to form by casting in sand, came into use.

12. Cannon were formerly dignified with great names. Charles V. of Spain had twelve, which he called after the *twelve apostles*. One at Bois-le-Duc is called the *devil;* a sixty-pounder, at Dover Castle, is called *Queen Elizabeth's pocket-pistol;* an eighty-pounder, at Berlin, is called the *thunderer;* two sixty-pounders, at Bremen, the *messengers of bad news*. But cannon are, at present, denominated from the weight of the balls which they carry; as six-pounders, eight-pounders, &c.

13. Fire-arms of a portable size were invented about the beginning of the sixteenth century. The musket was the first of this class of instruments that appeared; and the Spanish nation the first that adopted its use as a military weapon. It was originally very heavy, and could not be well supported in a horizontal position without a *rest*. The soldiers, on their march, carried only the rest and ammunition, while each was followed by a youth who bore the musket.

14. The powder was not ignited with a spark from a flint, but with a match. Afterwards, a lighter-match-lock musket was introduced, which was carried by the soldiers themselves. The rest, however, maintained its ground until about the middle of the seventeenth century. The troops throughout Europe were furnished with fire-locks, such as are now used, a little before the beginning of the eighteenth century.

15. The bayonet was invented, about the year 1640, at Bayonne; but it was not generally introduced until the pike was entirely discontinued, about sixty years afterwards. It was first carried by the side, and was used as a dagger in close fight; but, in 1690, the custom of fastening it to the muzzle of the fire-lock was commenced in France, and the example was soon followed throughout Europe.

16. Gunpowder, on which the use of fire-arms depends, is a composition of saltpetre, sulphur, and charcoal. The proportion of the ingredients is varied considerably in different countries, and by different manufacturers in the same country. But good gunpowder may be made of seventy-six parts of saltpetre, fifteen of charcoal, and nine of sulphur. These materials are first reduced to a fine powder separately, and then formed into a homogeneous mass by moistening the mixture with water, and pounding it for a considerable time in wooden mortars.

17. After the paste has been suffered to dry a little, it is forced through a kind of sieve. By this process, it is divided into grains, the size of which depends upon that of the holes through which they have been passed. The powder is then dried in ovens, and afterwards put into barrels, which are made to revolve on their axis. The friction produced by this motion destroys the asperities of the grains, and renders their surfaces smooth, and capable of easy ignition.

FARRIER.

THE VETERINARY SURGEON.

1. The horse, as well as the other domestic animals, is subject to a great variety of diseases, which, like those affecting the human system, are frequently under the control of medicinal remedies; and the same general means which are efficacious in healing the disorders of our race, are equally so in controlling those of the inferior part of the animal creation.

2. The great value of the domestic animals has rendered them, from the earliest periods, the objects of study and attention, not only while in health, but also when labouring under disease. For the latter state, a peculiar system was early formed, including a *materia medica*, and a general mode of treatment considerably different from those for human patients.

3. Of the authors of this system, whether Greek or Roman, nothing worthy of notice has been transmitted to us, beyond an occasional citation of names, in the works of Columella, a Roman writer, who flourished in the reign of Tiberius Cæsar, and in Vegetius Renatus, who lived two centuries afterwards. The former treated at large on the general management of domestic animals, and the latter more professedly on the diseases to which they are liable.

4. Both of these writers treated their subject in elegant classical Latin; but neither they nor any other ancient author whose works have reached us, had any professional acquaintance with medicine or surgery. Celsus is the only physician of those times who is said to have written on animal medicine; but this part of his works is not extant.

5. Xenophon is the oldest veterinary writer on record; but his treatise is confined to the training and management of the horse for war and the chase. The chief merit of the ancient writers on this subject consists in the dietetic rules and domestic management which they propose. Their medical prescriptions are said to be an inconsistent and often discordant jumble of many articles, devoid of rational aim, or probable efficacy.

6. On the revival of learning in Europe, when the anatomy and physiology of the human body had become grand objects of research in the Italian schools, veterinary anatomy attracted the attention of Ruini and others, whose descriptive labours on the body of the horse have since served for the ground-work and model to all the schools in Europe.

7. The works of the veterinary writers of antiquity were eagerly sought and translated in Italy and France, and the art was extensively cultivated, sometimes under regular medical professors. Every branch of the equine economy was pursued with assiduity and success, whether it related to harness and trappings, equitation and military menage, or the methodical treatment of the hoof, and the invention of various kinds of iron shoes. Evangelista of Milan distinguished himself in the education or breaking of the horse; and to him is attributed the invention of the martingale.

8. The new science having been extended over a great proportion of the continent of Europe, could scarcely fail of occasional communication with England: nevertheless, the medical treatment of horses and other domestic animals continued exclusively in the hands of farriers and cow-doctors, until some time in the first quarter of the eighteenth century.

9. At this period, that branch of this art which relates to the medical and surgical treatment of the horse, attracted the attention of William Gibson, who had acted in the capacity of army surgeon in the wars of Queen Anne. He was the first author of the regular medical profession, in England, who attempted to improve veterinary science; and the publication of his work forms an era in its annals; since his work became, and has continued to the present day, the basis of the superior practice of the English.

10. The eighteenth century was abundantly fruitful in veterinary pursuits and publications. France took the lead; but a zeal for this branch of science pervaded Germany and the states north of that part of Europe, and colleges were established in various countries, with the express view of cultivating this branch of the medical art. It is said that the French have improved the anatomical and surgical branches of the art, and the English those which relate to the application of medicines.

11. The first veterinary school was instituted at Lyons, in 1762. Another was established at Alfort, in 1766. A similar institution was opened at Berlin in 1792; and in the same year, one at St. Pancras, near London. In these colleges, lectures are given, and degrees conferred. In the diplomas, the graduate is denominated *veterinary surgeon.* A great number of these surgeons have been dispersed in the armies of Europe, as well as through the different countries, where they have been employed in the medical and surgical treatment of diseased animals, to the great advantage of their owners.

12. From the preceding account, it is evident that the light of science has shone conspicuously, in Europe, on the domestic animals, in relation to their treatment, both

while in health, and when labouring under disease. In the United States, we have no institution for the cultivation of this branch of knowledge. The press, however, has been prolific in the production of works treating on the various branches of the veterinary art; and many persons, by their aid, have rendered themselves competent to administer to animals in cases of disease, in a rational manner.

13. Nevertheless, the practice of animal medicine is confined chiefly to illiterate men, who, from their laborious habits, or from other causes, have not attained to that degree of information on animal diseases, and the general effects of medicine, that might enable them to prescribe their remedies on scientific principles. But this state of things is not peculiar to our country; for notwithstanding the laudable efforts of enlightened men in Europe, the blacksmiths form a vast majority of the horse-surgeons and physicians in every part of it; and the medical treatment of the other domestic animals is commonly intrusted to persons who are still more incompetent.

14. The attention of blacksmiths was very early turned to the diseases of the horse, from the practice of supplying him with shoes. The morbid affections of the foot were probably the first which attracted their notice; and descanting upon these induced the general belief, that they understood every other disease which might affect the animal.

15. These men, as labourers in iron, were orginally termed ferrers or ferriers, from the Latin word *ferrum*, iron,—and their craft, ferriery. These terms, by a usual corruption or improvement in language, have been changed to farrier and farriery, both of which still remain in general use, the former as applied to persons who shoe horses and administer to them medicines and surgical remedies, and the latter to the art itself, by which they are, or ought to be, guided.

16. The appellation of veterinary surgeon is applicable to persons who have received a diploma from some veterinary college, or who have, at least, studied animal medicine scientifically. There are a few such individuals in the United States; and the great value of the domestic animals, and the general increase of knowledge, certainly justify the expectation, that their number will increase.

QUESTIONS

ON

THE ARTICLES OF THE PRECEDING PAGES,

NUMBERED

ACCORDING TO THE PARAGRAPHS TO WHICH THEY REFER.

THE AGRICULTURIST.

1. What is meant by the word Agriculture?

2. What is said of the agriculture of the antediluvians?

3. To what did Noah resort for support immediately after the deluge?

4. Were the husbandmen, for several centuries after the flood, acquainted with any proper mode of restoring exhausted soils?

5 What people first adopted the measure of retaining perpetual possession of their lands?

6. By what means can the reader form some idea of the extent to which this art was cultivated, in ancient times?

7. Was agriculture neglected by the learned men of antiquity?

8. Until what period did agriculture maintain a respectable standing in the Roman empire?

9. When, and where, did husbandry begin to be practised, with considerable success, in England? Who wrote the first book on husbandry, in the English language?

10. When, and by whom, were improvements made on the theory of this author?

11. When did agriculture again receive a new impulse? When, and at whose suggestion, was the Board of Agriculture established?

12. Where have agricultural societies been formed, and periodical journals published, in imitation of those in Great Britain?

13. In what do the great modern improvements in husbandry consist?

14. To what science are we *indebted, for many of* the improved processes which relate to the amelioration of the soil?

15. What are the cultivators of the soil called, in the United States?

16. What is the general process of cultivating most of the productions which have been mentioned?

17. How are corn, beans, potatoes, and pumpkins cultivated?

18. How are the crops, mentioned in this paragraph, secured?

19. What course is pursued, in securing corn?

20. How do the blacks proceed, at their husking matches?

21. In what country did Indian corn and potatoes originate?

22. For what are the grasses valuable to man?

23. Where was rice first cultivated?

24. Where is rice now cultivated? How many crops do the Chinese obtain in a year, from the same ground?

25. How do they proceed, in raising a crop?

26. How is the crop cut? and how is the rice threshed and cleared?

27. When was rice introduced into the Carolinas? How is it there sown and managed?

28. Where is cotton cultivated? How many kinds of cotton are there produced in the Southern States?

29. How are the plants propagated, and managed while growing?

30. When is the cotton fit to be gathered?

31, 32. How are the seeds separated from the cotton? Describe the roller-gin, and saw-gin.

33, 34. Before the invention of the saw-gin, how were the seeds separated from the upland cottons? Who invented the saw-gin?

35. Where was the sugar-cane first cultivated?

36. When was the cane introduced into Arabia Felix? Who introduced it into America, and the West Indies? Where is it now cultivated?

37. When was sugar known only as a medicine, in Europe?

38. How is the sugar-cane propagated?

39. How is the juice of the cane expressed, evaporated, and cooled? How is the syrup separated from the sugar?

40. How is this sugar further purified? and where?

41. How is loaf-sugar manufactured?

42. What is molasses? From what is rum distilled?

43. From what is sugar manufactured in the Northern parts of the United States, and the Canadas?

44, 45. How is the sugar obtained from the sap? and how is it clarified?

46. What is said of lands in their native state?

47. How is land cleared by the Pennsylvanians?

48, 49. How is land cleared by settlers from New-England?

50. What is done with the ashes obtained in this mode of clearing land?

51, 52. What is the process of making pot-ash? and also of pearl-ash?

53, 54. Do the settlers usually complete the whole process? Is the trade in ashes profitable to the settlers?

THE HORTICULTURIST.

1. From what did the Creator form man? and in what situation did he place him?

2. What may be supposed to have been the state of this art before the flood?

3. What statement in scripture may be regarded as proof of the early attention to gardening after the flood?

4. What is one of the first indications of advancement towards civilization among savage nations?

5. At what stage of refinement does ornamental gardening begin to be attended to?

6. By whom was ornamental gardening practised from the eighth to the thirteenth century?

7. When was gardening introduced into England as a source of profit?

8. When did horticulture attract the attention of the first characters in England?

9. What is said of the advancement and present prevalence of English gardening?

10. What is said of Horticultural Societies?

11. What is said of authors who have written upon practical gardening?

12. What is said of periodical publications upon horticulture?

13. Can we draw a distinct line between horticulture and agriculture?

14. Name the divisions of a complete garden.

15. What is said of professed gardeners in Europe?

16. What is said of gardening in the United States?

17. What is said of the hot-house, and the green-house?

18. What vegetables are commonly cultivated in gardens for the table?

19. At what particular objects does the scientific horticulturalist aim in laying off his garden?

THE MILLER.

1. In what does the business of the miller consist?

2. What method of reducing grain to flour is the most simple?

3. What is said of the hand-mill?

4. In what particular does the modern corn or flour mill differ from the ancient hand-mill?

5. What is said of the surfaces of the stones?

6. What is said of the form of the two stones?

7. Explain the machinery of the common mill, as exhibited by the picture in this paragraph.

8. In what manner is the comminuted grain bolted?

9. Of what materials are mill-stones made?

10. In what manner is the miller paid for his services in a grist mill?

11. What is meant by a merchant-mill?

12. What agent is most commonly employed to move heavy machinery? and when was the windmill invented?

13. Where are our most celebrated flour-mills?

14. What is hominy? and in what manner is it prepared?

15. Describe the hominy mortar.

16. What kind of corn is commonly chosen for hominy?

17. How is hominy prepared for the table?

THE BAKER.

1. In what does the business of the baker consist?

2. When did man begin to use farinaceous grains, as his principal means of support?

3. In what manner was the method of making fermented bre[illegible]d?

[illegible] ner was bread [illegible] nvention of [illegible] al were [illegible] ed? [illegible] animal [illegible] d?

7. What kinds of grain are most commonly employed in making bread?

8. What are the component parts of flour?

9. How many general methods of making bread are there?

10. Explain the theory of making light bread.

11. What substances are used as substitutes for yeast and leaven?

12. Is the art of making bread universally practised?

13, 14. When did the baking of bread begin to be practised as a regular profession? What is said of the bakers of Rome?

15. In what manner is the price of bread regulated in many of the cities of Europe?

16. What is said of the laws regarding this subject in the United States?

17. What is said of the laborious nature of this business?

18. Describe the daily routine of the baker's labours.

19. What is said of the different branches of this business?

THE CONFECTIONER.

1. In what does the business of the confectioner consist?

3, 4, 5, 6, 7, 8, 9, 10. What are liquid and dry confects, jellies, marmalades, conserves, candies, sugar-plumbs, ice cream, cakes?

11. In what other articles does the confectioner deal?

12. In what manner is soda water prepared?

13. Of what materials are pies and tarts composed?

THE BREWER, AND THE DISTILLER.

THE BREWER.

1. What is meant by the art of brewing? What kind of grain is usually preferred by the brewer?

2, 3. By what means is barley converted into malt?

4, 5. Describe the process of mashing.

6. How many times does the same malt require to be mashed?

7. What is done with the product of the mashing-tun?

8. By what means is the fermentation effected?

9. When does the brewer's cleansing take place?

10. What are the denominations of the products of the brewery?

11. In what respects do the different kinds of beer differ from each other?

12. Why are ale and porter called stock liquors?

13. Where were fermented liquors first used?

14. What nation is most celebrated for brewing good liquors?

THE DISTILLER.

1. From what substances is alcohol extracted?

2, 3, 4. From what materials is whiskey obtained: and what is the process by which this liquor is produced?

5. What is done with the remains of the beer?

6. From what are brandy, rum, arrack, &c. distilled?

7. What is said of the alembic?

8. For what purposes are crude spirits re-distilled, after having been brought to market?

9. What is said of the deceptions practised in this kind of merchandise?

10. What is said of the ambix?

11. Were the ancients acquainted with alcohol?

12. What opinion with regard to the use of alcohol is becoming general?

13. What is said of the antiquity of the use of wine?

14, 15. Describe the process of making wine.

16. What deleterious substances are used to improve the sensible qualities of wine?

17. What kinds of wine are most usually met with in this country?

THE BUTCHER.

1, 2. What is said of the subsistence of man on vegetable and animal food? What is said of the preference of one to the other, in different climates?

3. What is said of the Divine permission and prohibitions in regard to the use of flesh as food?

4. Where did the doctrine of transmigration arise? in what countries did it spread in ancient times? and where is it still entertained?

5. What is the leading feature of this doctrine, and why does it lead to abstinence from the flesh of animals?

6. How are the people in the country supplied with meat? and how in the villages, large towns, and cities?

7. From whom do the butchers obtain their animals?

8. In what manner does the butcher proceed in slaughtering an ox?

9. Where is the meat sold in large towns and cities?

10. What is said of the employment of *runners*?

11. What is said of the health and corpulency of butchers?

THE TOBACCO PLANTER, AND THE TOBACCONIST.

THE TOBACCO PLANTER.

1. Of what country is tobacco a native production? What is said of the several names by which it has been distinguished?

2. When was this plant introduced into Europe?

3, 4. Detail the circumstances which were attendant upon its introduction.

6. What is said of the different species of this plant?

8. In what manner is co bed made?

9 When are the pla

fered to the field, and how is their cultivation continued?

10. What is said of the tobacco worms?

11. In what manner is the tobacco secured?

12. How is it prepared for market?

THE TOBACCONIST.

1. What is the business of the tobacconist?

2. How many kinds of snuff are there?

3. In what manner is snuff manufactured?

4. In what manner are the different kinds of snuff put up for sale?

5. Of how many principal parts are cigars composed?

6 Where is the best kind of tobacco for cigars cultivated?

7. How many cigars can an expert hand make in a day?

8. Where does the kind of tobacco grow, of which chewing tobacco is made?

9, 10. In what manner is chewing tobacco prepared?

11. What is said of the use of snuff as a dentifrice?

12. What is said of the effects of tobacco on the constitution?

13. What is said of the extent of the use of tobacco here?

14. In what manner is the use of tobacco perpetuated?

THE MANUFACTURER OF CLOTH, &c.

THE MANUFACTURER OF CLOTH.

1. In what manner were men clad in the primitive ages?

2. What fibres of the vegetable and animal kind are employed in the manufacture of cloth?

3. How many principal operations are comprised in the manufacture of cloth?

4. What objects are effected in carding? and in what manner is the operation performed?

5. What is said of machines for carding wool in the United States?

6. What kinds of wool are combed? and in what does the operation consist?

7. When, and by whom, was the first machine for combing wool invented?

8. In what does the process of spinning consist?

9, 10, 11. By whom, and in what manner, is the operation performed?

12. When, and by whom, was the *jenny* invented?

13. When, and by whom, was the *water spinning-frame* invented?

14. By whom, and when, was the *mule* invented?

15. In what manner are the fine and short wools carded and *spun in the* manufactories?

16. What is said of spinning worsted? and what of spinning flax, by machinery?

17. What is the first step preparatory to weaving?

18. After the warp has been wound on a cylindrical beam, how is it prepared for the reception of the filling?

19. Describe the manner in which weaving is performed.

20. What is said of weaving in general? and what of power looms?

21. By what means is the irregular nap removed from the finest cottons?

22. How are stuffs made of vegetable fibres whitened?

23. How are fine cottons converted into calico?

24. What is said of worsted fabrics?

25. To what kind of stuffs is the art of fulling applicable?

26. Describe the process of fulling.

27. In what manner is the nap raised, and cut off to an even surface?

28. What is said of the manufacture of cloth in families?

29, 30. Relate the history of the woollen manufacture in England.

31. What is said of the extent of the woollen manufacture in England?

32. What is said of the cotton and woollen manufacture in the United States?

THE SILK-WORM.

1. By what insect is silk produced? From what is the silkworm produced? and what are its several transformations?

2. In what manner are the fibres of the cocoon wound upon a reel?

3. What is done with the raw silk by the manufacturers?

4, What is said of the origin of the silk worm?

5. When did the Greeks and the Romans become acquainted with silk?

6. What is said of the costliness of silk in ancient times?

8. Until what period was the Roman empire supplied with silk by the Persians?

9. By whose assistance did Justinian obtain some eggs from India?

10. When, and by whom was the rearing of these worms introduced into Sicily?

11. By whom, was the silkworm introduced into England? and how has it succeeded there?

12. What is said regarding the silk-worm, and the silk manufacture in the United States?

THE DYER, AND THE CALICO PRINTER.

THE DYER.

1. In what does the art of dyeing consist?

2. What is the nature of the union of the colouring matter with the fibres?

3. In what manner are the several substances to be dyed, prepared for the process?

4. How are the substances used in dyeing divided?

5. Name the principal substances used as mordants.

6. Name the leading colours.

7, 8. What substances are used in making the dyes for these colours? and how are the intermediate hues produced?

10. What is said of the origin and antiquity of dyeing?

11. What was the favourite colour of the ancients? and how was the mode of communicating it suggested?

12. What is said of the use of this colour by the Jews and Babylonians?

14. What is said of the Tyrian purple?

16. What colour was second in repute among the ancients?

17. By what means was the art of dyeing lost, and how was it recovered, in the western parts of Europe?

18. What is said of indigo, and some other colouring substances?

THE CALICO PRINTER.

1. What arts are combined in calico printing?

2, 3, 4, 5, 6. Describe the process of calico printing.

7. In what respect does calico printing differ from dyeing?

8. What is said of this art in India?

9. When were calicoes first brought to Europe? and when was calico printing commenced in London? How many yards are supposed to be printed annually, in the United States?

THE HATTER.

1 In what does the business of the hatter consist?

2. What is done with the two kinds of hair, which cover the skins of the fur-clad animals?

3. Of what materials are the body of hats composed?

4, 5, 6, 7, 8, 9. Describe the process of felting.

10. In what manner are the hats coloured?

11. Describe the operations of the *finisher*.

15, 16, 17, 18. What is said of the different coverings for the head, in different ages and countries? What is said of the turban?

19. What is said of the ancient helmet?

20. What is said of the Romans, the Scotch, and the English?

21. What is said of the Chinese, in regard to their use of caps?

23. Can the origin of hats be ascertained with certainty?

24. What tradition have the hatters in regard to the origin of the art of felting?

25. When did hats become generally known?

26, 27. What is said of the adoption of the hat by the clergy?

28. What opposition was made to the introduction of hats in England?

THE ROPE-MAKER.

1. What vegetable substances are used as materials for ropes?

2. Where are the operations of rope-making performed?

3. In what does the first part of the process consist?

4, 5, 6. Describe the wheel of the rope-maker, and the operations of spinning.

7. In what does the second part of the process consist?

8. Of how many strands does cordage generally consist?

9, 10. In what manner are the strands formed into small cordage, and also into large cordage?

11. At what stage of the process, and in what manner, is tar applied to the material?

13. What is said of cotton yarn and Manilla hemp?

14. What is said of the use of animal fibre in the manufacture of ropes?

15. Where is hemp cultivated? What is said of flax, as a material for cordage, and of hemp, as a material for cloth?

16. What is said of the general utility of this manufacture?

17. Of what use are old ropes?

18. What is said of the invention of this art?

THE TAILOR.

1. In what does the business of the tailor consist?

2. In what manner is the measure of the person taken?

3. By what classes of workmen, are the several parts of the labour performed?

4. What is said of the employment of females in this business?

5. Name the instruments employed in performing the operations of the tailor.

6. What is said of the art of the master tailor, and his qualifications?

7. By whom was given the first hint as to the art of clothing the human body?

8. What is said of the primitive method of sewing?

9. What is said of the practice of this art as a business?

10. Describe the Roman *toga*.

11. What is said of the *tunica* of the Romans?

12. What is said of the *toga prætexta*, and *toga virilis*?

THE MILLINER, AND THE LADY'S DRESS-MAKER.

THE MILLINER.

1. Name some of the materials used by the milliner.

2. Describe the process of making a hat or bonnet.

3. What is said of Leghorns?

4. Describe the process of making hats from straw.

6. What is said of the antiquity of head-dresses?

7, 8. What is said of the head-dresses of the ladies, in the eighteenth century? and what of those of the present age?

THE LADY'S DRESS-MAKER.

1. What is said of the union of this business with that of the milliner?

2. Why are not the customers of the dress-maker easily pleased?

3. Why should the dress-maker understand something of anatomy and physiology?

4. From what country are the fashions for ladies' dresses generally procured?

THE BARBER.

1. What is the business of the barber?

2. What is said of the practice of shaving among the people of antiquity?

3. When was the practice introduced among the Romans?

4. Where did the first barbers of Rome shave their customers?

5. When was this custom banished from the western empire? and when was it again revived?

6. By whom was the custom of shaving introduced into Russia? and what circumstances attended its introduction?

7. In what manner did the Spaniards punish the loss of honour?

8. What anecdote is related of the brave John de Castro?

9. When did whiskers attain their highest degree of favour?

10. What is said of the whiskers of Confucius?

11. What are the usual requisites for shaving?

12. What is said of dressing the hair in ancient times?

13. In what manner did the adult Romans wear their hair?

15. What is said of the antiquity of artificial hair?

17. At what period were wigs first worn by the fashionables of Paris?

18. What is said of the opposition of the clergy of England to wigs?

19. What cause is assigned for the easy introduction of the wig?

20. What is said of the fashion of wearing wigs?

21, 22. What is said of manufacturing wigs and false curls?

24, 25. What is said of the performance of surgical operations by the barbers and bath-keepers? and what of the barber's sign?

THE TANNER AND THE CURRIER.

THE TANNER.

1. In what does the art of *tanning* consist?

2. *What is said respecting* the antiquity of the art of tanning?

3. What is said regarding the true principle of tanning?

4. By whom was the subject throughly investigated? and what was the result of the investigation?

5. Describe the skin which envelopes the bodies of animals.

6. What denomination is given to the skins of large animals? and what to those of small animals?

7, 8, 9. Describe the process of making sole-leather.

10. What is said of oak bark, and other astringent substances used for tanning?

11, 12. Describe the process of tanning calf-skins.

13. From what sources does the tanner obtain his hides and skins? and what is said of hides obtained from South America?

THE CURRIER.

1. What is the business of the currier?

3. Describe the process of dressing the calf-skin.

4. What is said of blacking horse-hides, and harness leather?

5. What is said of the divisions of the trade of the currier?

THE SHOE AND BOOT MAKER.

1. What is said of the antiquity of the shoe?

2. Of what materials did the people of antiquity manufacture their shoes?

3. What is said of the covering used for the feet by the Romans?

4. What kind of shoes were worn by the senators? and likewise by the women?

5. What is said of the boots worn in ancient times?

6. What is said in regard to the fashion of boots and shoes in different ages?

7. What is said of *rights* and *lefts*, and crimping?

9. What is said of the materials for boots and shoes, employed in Europe and America?

10. What is said of the method of carrying on this business?

11. What is said of the different sizes of shoes and boots?

12. Describe the process of making a leather shoe?

14. What is said of shoe-thread, and shoemaker's wax?

16. What is said of wooden pegs and brass nails?

17. What is said of journeymen confining their attention to particular kinds of work?

18. What is meant by being *on a tramp*, or *whipping the cat*?

19. What is said of *the finding stores*, and *the leather-cutter*?

THE SADDLER AND HARNESS MAKER, &c.

THE SADDLER AND HARNESS MAKER.

1. What is said of the invention of the saddle?

2. What did the rider use on the back of the horse, before the saddle came into use?

3. What is said of the use of the saddle among the Romans? and likewise in England?

4. What is said of the tree of the saddle?

5, 6. Describe the process of making a common saddle.

8. Describe the process of making bridles and harness.

THE TRUNK MAKER.

1. In what does the manufacture of trunks consist?

2. What is said of the materials of which the best kind of trunks are made?

3. How long has trunk-making been a separate trade?

THE SOAP BOILER, AND THE CANDLE MAKER.

THE SOAP BOILER.

1. In what does the business of the soap boiler consist?

2. In whose works does the earliest notice of soap occur?

3. What substances were used for cleansing the skin and articles of clothing, before soap was invented?

4. Name the substances most commonly employed in making soap.

5. What is said of soda?

6. What is said of *barilla* and *kelp*?

7, 8, 9, 10. Describe the process of making common brown or yellow soap?

11. In what manner is the soap cut into bars?

12, 13. What is said of the adulterations of soap? and in what manner may they be detected?

14. What is said of the manufacture of soft soap?

15. What is said of Marseilles white soap, Castile, and toilet soaps?

16. What is said of the manufacture of white soap?

17. In what manner is the mottled appearance of some soaps produced?

THE CANDLE MAKER.

1. Define the subject of t candle maker's labours.

3. What is said of the materials of which the wicks of candies are made?

4. In what manner are the wicks prepared?

5. In what manner is tallow separated from the membranous part of suet?

6, 7. How is tried tallow prepared for application to the wicks? and in what manner is the application made?

9. Describe the process of making mould candles?

11. Describe the manner in which bees'-wax is whitened, or bleached?

12. From what animal is spermaceti obtained?

13, 14, 15. Describe the process by which spermaceti is separated from the oil.

16. What use is made of sperm-oil?

17. What is said of the origin of the art of making candles?

18. What is said of the lamps used in ancient times?

19. What is said of the tallow tree?

THE COMB-MAKER AND THE BRUSH-MAKER.

THE COMB-MAKER.

1. For what purposes is the comb used, and of what materials is it made?

2. What is said of the invention of the comb?

3. What is said of the different species of the turtle?

4. What is said of the use of the shell of the hawk's-bill turtle by the ancients?

5, 6. What is the general size of the hawk's-bill turtle? and on what part of the animal does the shell grow?

7, 8, 9. In making combs from the horns of cattle, what is done before the teeth are cut? and in what manner are the teeth cut?

10. What is said of the *twinning machine*?

11. How are the combs polished?

12, 13. What colours are preferred? and in what manner are they produced?

14. How are the combs brought to the proper shape?

16. What is said of welding together pieces of shell?

17. What is said of carved work on combs?

THE BRUSH-MAKER.

1. What is said of the general use of brushes?

2. From what sources does the brush-maker obtain his stocks and handles?

3. In what does the first part of the process of brush-making consist?

4. Whence are the bristles obtained?

5. In what state are the bristles, when they come into the hands of the brush-maker?

6. In what manner are the bristles assorted into different lengths?

7. By what means are the bristles fastened into the stocks of the brushes?

9. For what purposes is a veneer applied to the back of the brush?

10. What part of the manufacture does the ornamenter perform?

THE TAVERN-KEEPER.

1. What are the several denominations applied to houses of public entertainment?

2. Why is the business of the tavern-keeper one of great public utility?

3. What is said of the sustenance and protection of travellers in the early ages?

4. What is said of the hospitality of the ancients?

5. What precautions were observed by strangers among the Greeks, when one applied for lodging?

6, 7. What is said of arrangements for mutual accommodation among the ancients?

8. What is said of the hospitality of the middle ages?

9. What is said of the hospitality of the nobles of Europe in particular?

10. What circumstances led to the general establishment of inns?

11. At what period were inns established by law in Scotland?

12. What is said of legislative enactments as applied to this business?

13. What is said of the amount of travelling, and what of the taverns of the present century?

15. What is said of the tavern-keeper's license?

16, 17. What is said of temperance taverns?

THE HUNTER.

1. What is said of hunting and fishing as the primary occupations of man?

2, 3. What is said of many of the branches of Noah's family?

4. What is said of Nimrod?

6. What is said of William the Conqueror? and what of the game laws of Great Britain?

8. What quadrupeds are most hunted in Europe?

9. What is said of hunting the wolf?

10. In what manner is the lion hunted in Africa?

12. Which are the most formidable animals in North America?

13. In what manner do the North American Indians hunt the bison?

14. What is said of the fur-clad animals in North America, and in the Northern parts of Asia?

15. What is said of a fur company, formed by Prince Rupert and others? and what of the North-West Fur Company?

16. With what commodities do these companies supply the Indians? and what skins do they receive in return?

17, 18. In what manner is the intercourse managed with the Indians?

19. What is said of the prosecution of the fur-trade by a class of men in Missouri?

20. What is said of the effects of the warfare which has been carried on against the larger quadrupeds, and fur-clad animals of North America?

21, 22. What is said of the fur trade prosecuted on the north-west coast of America?

23. What animals are the chief objects of pursuit by the hunters of Siberia? What is said of the exiles and conquered tribes of Siberia?

24. Where did the custom of wearing furs originate?

THE FISHERMAN.

1. What is said of the use of fishes as food in the early ages?

2, 3. Where is found the earliest notice of the actual use of this class of animals?

4. At what time had fish become a regular article of diet in all parts subject to the Roman empire?

5. What methods of catching fish were pursued in ancient times?

6. What is said of the great variety of fish by Linnæus?

7. What is said of the supplying of towns and cities with fresh fish?

8. What is said of the different varieties of the herring?

9, 10. What is said of the winter residence of the herring, and what of its emigrations?

11. How far south do these fish proceed?

12. What is said of the young herring?

13, 14, 15. Where, and how are these fish caught?

16. How is this fish estimated in the Southern states?

17. By whom was this fish brought into notice?

18. What is said of the shad?

19. What is said of the character, numbers, and general utility of the mackerel?

20. In what manner is this fish caught?

21. Why was this fish much esteemed by the Romans?

22. To what genus of fishes does the salmon belong? and where is it found?

23. What is said in regard to the attachment of the salmon to their native river, and to the spot for the annual deposit of their spawn?

25. By what means are salmon caught?

26. In what countries are salmon fisheries numerous?

27. In what parts of Europe is the cod-fish found in the greatest abundance?

28. Where are the chief places of resort for this fish on the coasts of America?

29. What nations have acquired the right to catch and cure fish on the Grand Banks, and several other of the British possessions.

30. By what means are the fish caught on the Grand Banks?

31. In what manner are they treated after having been caught?

32. How are the fish caught on the coast of Labrador, and at the other places mentioned?

33. What kind of seal is the most numerous and important?

34. On what accounts is this animal valuable?

36. What is said of a sealing voyage to the Antarctic ocean?

37, 38. What months of the year are best adapted for sealing in the Arctic ocean? In what manner are the seals caught? and how are the skin and blubber taken off and secured?

39. What is said of the different species of the whale?

40. Where is the mystecetus found?

41. On what principles are the vessels engaged in this fishery fitted out?

42. When do the whalers commence operations in the northern latitudes? and between what latitudes are the whales met with?

43. What is said of the preparations on the fishing stations for attacking the whale?

45. Describe the conduct of the fishermen in pursuit of a whale, and likewise that of the latter when pursued?

46, 47. What is the conduct of the whale after having been struck? and what of the men when fast to the animal?

48. What particular position is favourable to catching this animal? and what unfavourable?

49. Describe the manner in which the blubber is secured.

50. Describe the blubber.

51. What is said of the whalebone?

52. What is done with the chunks of blubber before the whalers leave the fishing station?

53. In what manner is the oil separated from the fritters or fenks?

54. Where is the spermaceti cachalot found in the greatest numbers?

55. In what manner do the whalers proceed in catching this animal?

56. How much oil is obtained from a large cachalot?

57. What people first prosecuted the whale fishery?

58. What led to the discovery of the principal haunts of the whale? and where were these animals found in the greatest abundance?

59. What is said of the Dutch whale-fishery?

60. What is said of the English whale-fishery?

61, 62. What is said of the whale-fishery of the United States?

THE SHIP-WRIGHT.

1 What is said of Noah's ark?

2. What is said of the progressive steps in navigation among the ancient Egyptians?

3. What is said of the use of the raft by the Phœnicians?

4. For what purposes were the first vessels constructed by the Phœnicians? and what was their shape?

5. What is said of the successive improvements of ships in ancient times? What was the approved length of a ship of war? and likewise that for mercantile purposes?

6. What is said of the mast, oars, rowers, and bow?

7. What is said of the size of vessels in ancient times?

8. What causes occasioned a retrogression, and, in some parts of Europe, nearly a total destruction of the art of building ships?

9. What circumstances occasioned a renewal of this art in the middle ages?

10. To what particular discovery is attributed the great change in the general construction of vessels?

11. To what nations are we indebted for most of the improvements in ship-building?

12. What is said of the improvements made in the United States?

13. What is the first thing done towards building a vessel?

14. What kinds of timber are used in the United States?

15. What is said of the crooked sticks which form the sides of the vessel?

16. In what manner do the workmen proceed in fashioning the various parts of a vessel?

17. In what manner are the several parts of the frame put together?

18. What is said of applying and fastening on the planks?

19. What is said of the caulker and scraper?

20. What is said of sheathing the bottom of the vessel?

21. What are the immediate preparations for a launch?

22. When every thing has been made ready, what is done, to cause the vessel to glide into the water?

23. What is said of a launch in ancient times? and what of it in modern times?

24. What is said of equipping the vessel?

THE MARINER.

1. In what does the business of the mariner consist? and what does Horace say of the first seaman?

2. What is said of the advantages resulting to the world at large from this business?

4. *What is* said of the sailors *of antiquity in* regard to their *dependence on the land*?

5. What is said of the qualifications of a skilful pilot in ancient times?

6. What is said of the offering of sacrifices, and the observance of omens before undertaking a voyage?

7. What is said of the sailors who had escaped the multiplied dangers of the sea?

8. What is said of the present existence of similar customs in regard to ship-wrecked mariners?

9. What is said of the navigation of the Carthaginians?

10. What is said of the decline and revival of navigation?

11. What was the chief cause of the rapid advance in navigation?

12. What is said of the manner of using the magnetic needle, until the year 1302?

14. To what nation is navigation indebted for many valuable improvements?

15, 16. What is said of the discovery of the New World by Columbus?

18. What instruments are now employed in navigation?

19, 20. For what purposes are the mariner's compass, the azimuth compass, the quadrant, the sextant, the chronometer, the half-minute glass, the log, and the sounding line severally used?

21. What is meant by navigation *proper*? and what by navigation *common*?

22. What is said of the application of steam to the purposes of navigation?

23. What is the chief obstacle to the employment of steam in long voyages?

24. When, and by whom was the expansive force of steam discovered? Who constructed the first working steam engine?

25. Who first suggested steam navigation? and who rendered it completely successful in practice?

27. What is said of Greenwich Hospital?

28. What is said of the general character of seamen in every age of the world?

29. What is said of the superstitions of many of the inhabitants of this country?

THE MERCHANT.

1. What is meant by the word merchant?

2. How are importing and exporting merchants distinguished from each other?

3. How is the business of merchants transacted in foreign countries?

4. What is said of the imposition of duties on foreign goods?

5. What is said of the sale of goods to merchants of different grades, before they come to the consumers?

6. What is said of dealers in a small way?

7. What is said of the general retail merchant?

8. What is said of barter?

9. How often do the country storekeepers visit the cities, to replenish their stores?

10. What is said of the high antiquity of commerce? What is said of the precious metals as a standard of value?

11. Where do we find the earliest hint respecting the existence of trade between different nations?

12. What is said of Egypt as the emporium of commerce?

13. What is said of the Phœnicians, and their chief cities, Tyre and Sidon?

14. What effect had the settlement of the Israelites, in the "Promised Land," on the Phœnicians?

15. What more is said of the colonial system of the Phœnicians?

16. What is said of the policy pursued by Carthage? and what of the three "Punic wars"?

17. At what period was Tyre in its most prosperous state? and when was it finally destroyed?

18. What is said of the city of Alexandria?

19. What is said of the prosecution of the plans of Alexander by Ptolemy?

20. What is said of the fleets of Ptolemy, and trade to India?

21. What is said of the Greeks, in regard to their attention to nautical affairs? and what of Corinth?

22. When did Rome become the great mart for the sale of merchandise? and what did the Romans give in return for it?

23. What more is said of the city of Rome?

24. When was Byzantium made the seat of the Roman empire? and what were the effects of this measure?

25. At what period did the invasions of the Roman empire commence? and what were their effects on commerce and the arts?

26. What is said of the continuance of trade in the Eastern empire?

27. What is said of the conquest of the Saracens? and their enjoyment of the eastern trade?

28. What is said of the prejudice of the Christians against the followers of Mohammed?

29. What European power first rose to commercial eminence?

30. What is said of the houses first built by the refugees?

31. When do we find the Venitians trading to Constantinople? and likewise at Alexandria? What cities rivalled Venice in the tenth century?

32. What is said of the Crusades?

33. Where did commerce and manufactures begin to command attention in the thirteenth century? What precautions were taken against robbers and banditti?

34. What is said of the Hanse Towns?

35. Where, and how often did the representatives of the league meet?

36. What were the objects of the league, as disclosed in the fourteenth century?

37. By what means was the treasury of the league supplied?

38. Why did the princes of Europe combine against the association? and when did they command their cities to withdraw from it?

39. How long did the trade

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the East Indies continue to be carried on through Persia and Egypt?

40. What effect had the discovery of America, and the use of the new pathway to India, on the people of Europe?

41. What nation soon gained the whole control of the East India trade?

42. When was Portugal subdued by Philip II. King of Spain?

43. What is said of the people of Holland, and those of six other provinces, in regard to their war with Spain, and their operations in the East Indies?

44. How long did the United Provinces enjoy the whole trade of the East?

45. What is said of the commerce of the British Islands, previous to the last century?

46. What is said of the commerce of Great Britain, since Elizabeth ascended the throne?

47. What is said of the commerce of the United States?

48. How many kinds of banks are there?

49. When, and where, was the first bank established?

50. What is said of the antiquity of lending houses?

51. What is said of the free gifts collected by the church in the early ages of Christianity?

52. What is said of the permission of the Roman Pontiff in regard to charging interest on loans?

53. What is said of the Jews and Merchants of Lombardy?

54. From what circumstances originated bills of exchange?

55. When was the Bank of England established?

56, What is said of banking institutions in this country?

57. What is the nature of the business done by our banks?

58. What is said of the Bank of North America?

59. What is the amount of the whole banking capital in the United States?

THE AUCTIONEER.

1. What is an auctioneer?

2, 3. What is said of the laws and usages regarding sales by auction in the several states of our Union?

4. What is said of the sale of merchandise by auction in our principal cities?

5. In what manner is a proposed sale at auction made known?

6. In what manner is a sale of this kind managed?

7. What is said of the "sale by inch of candle"?

8. What is said of credits given at these sales?

9. What is said of this mode of sale in the compulsory payment of debts?

10. What is said of it, in the settlement of the estates of deceased persons?

11. What is said of the sale by auction among the Romans?

12. What is said of suppressing sales of merchandise at auction?

THE CLERGYMAN.

1. What is said of the choice of the Apostles by our Saviour, and their commission?

2. When did the apostles commence their enterprise? and what success attended their labours?

3. What is said of the ordination of other persons for this same work?

When did the Christians
me superior in numbers to
agans of the Roman em-

Where did the Christians
first and second centuries
for worship?

What is said of the action
church, in matters
rest?

8. What is said of the subjection of the whole church to the Pope of Rome, and the Patriarch of Constantinople?

9. Why was the conquest of the Roman empire, by the barbarians, injurious to the church?

10. When did Martin Luther begin his opposition to certain practices and doctrines of the church?

11. Who were distinguished by the appellations, *Reformers* and *Protestants*?

12. What division of the church is called by the Roman Catholics, the *Western Schism*? and what the *Eastern Schism*?

13. What has been the ostensible object of all the churches differing from the Romish communion?

14, 15, 16, 17. What is said of the government of the different churches?

18. What literary and religious qualifications have been required for admission to orders?

19. What is said of the clergy of the Roman Catholic church?

20. What are the especial duties of clergymen?

31. Why do ministers of the gospel occupy an elevated stand in all Christian communities?

22. How are the institutions of religion supported?

23, 24, 25. What is said of the salary of the ministers of the gospel?

THE ATTORNEY AT LAW.

1. What is an attorney at law?

2. In what has this profession its foundation?

3, 4. What does municipal law embrace? What is meant by *statute law*, and what by common law?

5. How many departments of government are provided for, in the constitutions of the United States, and of the several states?

6. Where is the judicial power of the United States vested?

7. Of what cases does the judiciary of the United States take cognisance?

8, 9, 10. What is said of the judiciary systems of the different States? What is said of the office of justice of the peace?

11. What qualifications are required for practising in the magistrate's court?

12. What is said of the county courts, and what of the superior courts?

13. What is said of the decision of civil cases on principles of equity?

15. When a client has stated his case to his attorney, what is the particular province of the latter?

16, 17. In what manner is the suit managed in the county court?

18. What causes are brought before the judge or judges for adjudication?

19. What business of a private nature has the lawyer?

20. What is said of the utility and responsibility of this profession?

THE PHYSICIAN.

1. On what is the profession of the physician founded?

2, 3. Where does the scripture seem to place the origin of diseases and other calamities of men? What is the substance of the Grecian fable of Pandora's box?

4. Why may we infer that medicinal remedies were applied in the earliest ages of the human race?

5. To what was the origin of diseases attributed in some of the ancient nations?

6. Where was the healing art cultivated at an early period?

7. What custom of the Chaldeans is alluded to in this paragraph?

8. Where were the first records of medicine kept?

9. Who is esteemed the father of medicine?

10. Under whose patronage did a medical school become eminent in Egypt?

11. How long did Rome exist without a professional physician in it?

12. What was done by the Romans in cases of pestilence?

13. Who was the first who practised physic at Rome, as an art?

14. What was the effect of Cato's influence against the Greek physicians?

15. Who was the first medical writer of consideration at Rome?

16. What is said of Galen?

17. After the destruction of the Western empire, where was the science of medicine cultivated?

18. When and where, did the caliph Almonsur establish a hospital for the sick?

19. What is said of the progress of the science of medicine in this paragraph?

20. To whom was the cure of diseases confided in Europe, previous to the revival of medicine?

21. When did chemistry first begin to attract attention?—When, and by whom, was the circulation of the blood discovered?

22. What is said of the discoveries and theories of the seventeenth century?

23. What is said of the members of this profession in the present century?

24. Name the principal branches of medical science.

25. What is said of the advantages of a diploma?

26. What is said of the practice of this profession?

THE CHEMIST.

1. What is the object of the scientific chemist?

2. What is said of the comprehensiveness of chemistry?

3. What is said of the origin and meaning of the word chemistry?

4. What was the leading doctrine of the alchymistic philosophers?

5. What is said of the writers on alchymy between the ter and the sixteenth centuries?

6. What is said of the [illegible]sitions of the alchymists?

[illegible]

THE [illegible] AND A[illegible]

[illegible]

THE DENTIST.

1. What is said of the subjection of the human family to disease in the teeth?

4, 5. What is said of the two sets of teeth which appear at different periods of life?

6. What is said of the great alterations required, while the one set is being changed for the other?

8. What is said of the attention to the teeth required between the ages of six and fifteen?

9. What is said of the substances composing the teeth?

10, 11, 12, 13. What is said of caries?

14, 15. What is said of the treatment of caries, when the affection is but slight?

16, 17, 18. What is said of filling carious teeth?

19. What is said of the efficacy of this operation?

20. What is said of the extraction of teeth?

21, 22, 23, 24. What is said of the nature and effects of tartar?

26. What is the remedy for diseases arising from tartar?

25. Why does a great proportion of dental operations consist in inserting and extracting teeth?

20. What is the common opinion relative to the extraction of teeth?

21, 22. What is said of the insertion of artificial teeth? and what of their materials?

23, 24. What is said of surgical operations performed on the teeth in ancient times?

25, 26. What is said of the decline and revival of the art of dentistry?

THE TEACHER.

1. What is said of schools in [illegible], where priestly and despotism prevailed? What is said of schools in [illegible] cities? What is said of schools among the Romans? How came teachers to be [illegible]? What is [illegible]

6. What is said of Christianity as regards its influence on education?

7. What branches of learning were taught in the cathedral schools?

8. When were these schools surpassed by the conventual schools?

9. With what order of monks were these schools connected?

10, 11. What is said of the decree of Charlemagne in relation to schools?

12. What is said of the schools of the Jewish rabbins? and what of the Arabian schools?

13. What is said of the eminent men who proceeded from the conventual schools?

14. What is said of the origin of universities?

15. What is said of the division of the students into *nations*?

16, 17. What is said of academical degrees?

18. What is said of the colleges in the early universities?

19. In what manner were the teachers in the universities paid?

20. To what influence did the universities become subject?

21. What is said of popular schools, connected with the convents?

22. What is said of the lower parish schools?

23. What is said of the teachers employed in the trivial and other schools?

25. What is said of the Jeronymites?

26. What is said of the study of the ancient classics?

27. What is said of the influence of the art of printing, and of the reformation?

29, 30, 31, 32. What is said of education in Italy, Spain, Portugal, Austria, and France?

33, 34, 35. What is said of education in England, Ireland, Scotland, and Russia?

36. From what circumstance has the great attention to education in the United States arisen?

38, 39. What particulars are mentioned in relation to schools, in the states in which they are established by law?

40. Why do these schools fail in fully accomplishing the ends for which they have been instituted?

41. What is said of the public schools in the cities and populous towns?

42. What is said of select schools and private academies?

43. What is said of private tuition and schools in the southern states?

THE MUSICIAN, AND THE MUSICAL INSTRUMENT MAKER.

1. What is meant by the word music?

2. What is said of the use of musical instruments before the flood?

3. What is said of music among the Hebrews?

4, 5. What is said of music among the Greeks?

6. When did the Greeks begin to cultivate music as a science?

7. From whom did the Romans derive their music?

8. What is said of the use of musical instruments by the Romans?

9, 10. What is said of the manner of expressing musical tones in ancient times?

11. In what way was the time of the notes indicated?

12. In what manner were the fifteen chief notes of the Greeks expressed by the Romans?

13. What improvements were made by Guido Aretine?

14. Who invented notes by which the duration of sound could be determined?

16. What is said of the manner of singing, by the Christians, in the early days of the church?

17. What is said of the influence of a new singing-school established by Gregory the Great?

18. What is said of the *Gregorian chant?*

19. What is said of music in distinct parts?

20. What is said of the influence of the reformation on sacred music?

21. What is said of the free chamber style, and the opera?

22, 23. What is said of the employment of the musician? and what of the professors of music?

THE MUSICAL INSTRUMENT MAKER.

1. What operations are united in this business?

3, 4. Describe the essential and prominent parts of the organ.

5. What is said of the fingering of the organ?

6. Where is the largest organ?

7. At what period were organs first employed in churches?

8. What is said of the *hand* or *barrel organ?*

9. What is said of the instruments belonging to the class of horns?

10. What is said of the instruments of the flute kind?

11, 12, 13. What is said of stringed instruments? and what of the piano forte, in particular?

14. What is said of instruments of percussion?

15, 16. What is said of the bagpipe?

THE SCULPTOR.

1. What operations are included in the art of sculpture?

2. What are the principal productions of this art?

3. What is meant by each of the terms, *alto relievo, mezzo relievo,* and *basso relievo?*

4. What course of study is essential to proficiency in sculpture?

5. What is said of a model to guide the operator in the execution of a proposed work?

6. In what manner is the stone wrought and polished?

8, 9, 10, 11. From what subjects are casts taken in plaster and bronze? and in what manner are they taken in plaster?

13. What is siad of moulds made of a warm solution of glue?

14, 15. Explain the process of taking casts from statues in bronze.

16. What is said of the great antiquity of this art?

17. In what writings do we find the first notice of this art?

18. What is said of the exi

[illegible] of sculpture and painting among the [illegible] in the time of [illegible]?

15, 16. What is said of sculpture among the Egyptians?

17. What relics among the [illegible] [illegible] [illegible] the sculptures?

18. What is said of Dædalus?

19. What is said of the [illegible] of [illegible]?

20. When did Phidias live?

21. What is said of the death and some of the works of Phidias?

22. Who were the immediate successors of Phidias? What is said of the succeeding age?

23, 24. What causes are assigned for the great superiority of the Greeks in sculpture?

25. How were the fine arts affected by the conquest of the Romans?

26. What is said of the encouragement of the arts at Rome and at Constantinople?

27. What is said of the decline of sculpture, and what of the revival of the arts of design?

28. By what means was this improvement promoted?

29, 30. What is said of Nicolo and John Pisano?

31, 32. What is said of [illegible] [illegible] [illegible] [illegible]?

33. What is said of Michael Angelo Buonarroti?

34. What is said of the decline of sculpture, and what of its revival by Antonio Canova?

35. What is said of the fine arts in France?

36. What is said of sculpture in Spain, Germany, Holland, and England? What is said of the cultivation of the fine arts in the United States?

THE PAINTER.

1. What is painting?

2. Name the different branches into which the theory and practice of this art are divided. What is meant by invention?

3, 4, 5. What is meant by each of the terms, composition, design, and perspective?

6, 7. What is said of chiaro oscuro?

8. What is said of the employment of coloring substances, and the manner of their application?

9. What have given rise to the different kinds of painting?

10. What is said of painting with crayons, and in water-colours?

11, 12, 13. What is said of painting in distemper, in fresco, and in oil?

14. What is said of mosaics, or mosaic paintings?

15. Into how many classes are drawings and paintings divided?

16. What is the foundation of the arts of design?

17, 18. What is said of the antiquity of painting and sculpture?

19. What is said of the art of painting in Egypt?

21. For what purpose was painting employed in the early days of its existence?

23. Describe the different kinds of painting, as marked by the successive stages of the art among the Greeks.

24. What is said of a picture called the battle of the Magnetes?

25. What is said of Aglaophon and Polygnotus?

26. Who carried the art of painting to the greatest perfection to which it attained in ancient times?

27. What is said of Apelles?

28. What is said of the decline of this art among the Greeks?

29, 30. What is said of painters, and the art of painting, among the Romans?

31. When did the Romans encourage the Grecian artists with great munificence?

32. What is said of the decline, preservation, and revival of sculpture, painting, and architecture?

33, 34. What is said of Giovanni Cimabue?

35, 36. What is said of Giotto?

37. What is said of the Academy of St. Luke?

38, 39. What is said of Masaccio? and what of Leonardo da Vinci?

40. What is said of the introduction of oil, as a vehicle for paints?

41. What is said of painting in Flanders and Germany?

42. When, and by whom, was the art of painting perfected?

43. By whom was the art essentially aided in its progressive stages of advancement?

45. What is said of Rubens and Rembrandt? and what of their scholars?

46, 47, 48, 49. What is said of the art in Spain, France, England, and English America?

THE ENGRAVER.

WOOD ENGRAVING.

is said of engraving in
?

at is said of engraving by the Chinese?

w early was this art practised in various parts of Europe? What were the earliest subjects executed?

3, 4. What is said of Block-books?

5. What is said of the art near the close of the fifteenth century? and also in the sixteenth and eighteenth centuries?

6. On what kinds of wood did the earlier artist operate, and what kind is now used?

7. How did the engravers, in the infancy of the art, prepare the wood? and how do they now do it?

8. In what manner is the drawing made on the block? and how is the engraving executed?

9. What is said of the character of wood engravings? and what of their convenience?

THE COPPERPLATE ENGRAVER.

1. Why are the engravers on metallic surfaces generally, denominated copperplate engravers?

2, 3. Describe the principal instruments employed by this artist.

4. What are the principal varieties or styles of engraving on copper?

5, 6, 7. What is said of *line engraving?*

8. What is said of *stippling?*

9, 10, 11. What is said of *etching?*

12, 13. What is said of *mezzotinto?*

14, 15, 16, 17. What is said of *aqua-tinta?*

18, 19, 20. What is said of *steel engraving?*

THE COPPERPLATE PRINTER.

1. What is the business of the copperplate printer?

2. What is said of the claims of different nations to the honour of introducing this art?

3. What incident suggested the idea of taking impressions from engraved plates?

4. Of what materials is the ink composed which is used in this kind of printing?

5, 6. Describe the process of copperplate printing.

7. What number of impressions can be taken from engraved copperplates?

8, 9. What is said of engravings on plates of steel, and the method of their transfer from one plate to another?

10. Why have engraving and copperplate printing become employments of considerable importance?

THE LITHOGRAPHER.

1. What is the origin of the word lithography, and what the nature of the art to which the term is applied?

2. What kinds of stone are used in this art?

3. In what manner are the stones prepared for use?

4. What is said of making the drawing on the stone?

5. What is said of lithographic ink and chalk?

6. In what manner is the drawing prepared for taking impressions?

7, 8. What is the composition of the ink used in this kind of printing? and in what manner are impressions taken?

9. What number of impressions may be taken from the different kinds of drawings?

10. In what manner can impressions from engravings be multiplied indefinitely?

11. What is said of the invention of lithography?

12. What was the character of the first productions of the art?

THE AUTHOR.

1. What is meant by the word author?

2. On what subjects do authors commonly write?

3, 4. What is said of tradition, and other means of transmitting information to posterity, before the invention of letters?

5. What is said of the claims of different nations to the invention of letters?

6. What is said of the Pentateuch?

7. From what source did alphabetical writing spring?

8. What is said of the ancient alphabets? and what of the conformation of the letters of different languages?

9. What is said of the mode of arranging the letters in writing?

10. What is said of literary property in ancient times?

11, 12, 13. What legislative protection has been extended to literary property in England, at different times?

14. What is said of the jurisdiction of, and laws concerning, this subject in the United States?

15, 16. What is said of literary property in France, Germany, and some other countries?

17. Why have not literary productions been placed on the same footing with other property?

18. Do authors publish their own works?

THE PRINTER.

1. From what did the art of printing arise?

2. What is said of the uncertainty which rests upon the history of printing?

3, 4. What statements are made in support of the claims of Haerlem? and what in opposition to them?

5, 6, 7, 8. What particulars are stated of the early operations in printing at Mentz?

9. What is said of Faust and Peter Schœffer?

10. By whose aid did Guttemburg establish another press?

11. Who completed the invention of the art of printing?

12, 13. What particulars are related of the sale of Latin Bibles in Paris by Faust?

14. What is said of the romance of "Dr. Faustus and the Devil"?

15. What is said of the death of Faust, Geinsfleisch, and Guttemburg?

16. What is said of the use of vellum for the earliest printed books?

17. What is said of the secrecy observed by the Mentz printers?

18. Into how many places was the art of printing introduced before the year 1500?

19. In what country did printed newspapers originate?

20. When did the first newspaper appear in England?

21. What is said of the newspapers in Great Britain and Ireland in 1829?

22. What is said of the newspapers in the United States?

23. What is said of periodicals in France?

24. What is said of the regular periodicals of Europe?

25. What is said of the workmen in a printing office?

26. How are the types arranged in the *case for use*?

27. What is said of the *composing-stick*, and what of the manner of using it?

28. What is said of the use of *quadrats*, and the *galley*?

29. What is said of dividing the columns of types into pages, and *locking* them up in a *chase*?

30. What is said of the *proof*?

31, 32. Describe the manner in which impressions are taken from the types on paper.

33. What is said of the improvements made in the printing business within the present century?

34. What is said of printing by machinery?

THE TYPE-FOUNDER.

1. What are types? and of what materials are they composed?

2. What is said of the matrix and mould used in casting types?

3. In what manner is the casting of types performed?

4, 5. Describe the several operations connected with the finishing of these instruments.

6. Name the principal sizes of types. What is meant by a *fount* of types?

7. Who invented the art of casting types?

8, 9. What character was first employed in printing? What is said of the Old English, Roman, and Italic characters?

THE STEREOTYPER.

1. What is the origin of the word *stereotype*?

2. Of what material, and in what manner, are moulds formed in stereotyping?

3. How is a cast taken from a mould thus formed?

4. Describe the operations performed on the plates in the finishing room.

5. How are the plates applied in printing?

6, 7, 8, 9, 10. Give the history of this art, as stated in these paragraphs.

THE PAPER-MAKER, AND THE BOOKBINDER.

THE PAPER-MAKER.

1, 2, 3. On what materials, and with what instruments, was writing performed in the early days of the art?

4. In what substances were materials found, adapted to works *of magnitude*?

5. *Where did the plant papy*rus grow? and how was paper manufactured from it?

6. Describe the process of making parchment.

8. At what place was the greatest quantity of paper manufactured?

9, 10, 11. Give the history of the modern paper manufacture.

12. Name the materials most commonly employed.

14. Describe the first stage of the process.

15. By what means are the rags reduced to a pulp?

16. How is the pulp rendered perfectly clean? and by what substances is it bleached?

17. By what means, and in what manner, are the fibrous particles formed into a continued sheet of paper?

19, 20. Describe the successive operations necessary to complete the manufacture.

22. Describe the method of making paper *by hand* or by means of *moulds*.

THE BOOKBINDER.

1. What is bookbinding?

2, 3. What is said of the antiquity of this art? and the earliest method of binding books?

4. In what manner is the folding of the sheets performed?

5. In what manner are they gathered?

6. In what manner are the sheets sewed together?

7. How does the workman proceed in preparing the book for the application of the pasteboard?

8. With what instrument are the leaves trimmed?

9. With what material, and in what manner, are the books covered?

10. In what manner are the covers sprinkled or marbled?

11. What more is done, to prepare the books for the reception of the ornaments?

12, 13. In what do the ornaments consist? and in what manner are they applied?

14. When are books said to be *full-bound*? and when *half-bound*?

15. How are the different sizes of books designated?

THE BOOKSELLER.

1. How was the book business carried on, before the invention of typography?

2. What is said of the copying performed by the monks?

3. What is said of the value of books in those times?

4. What is said of the dealers in books called *stationarii*?

5. Who were the first booksellers, after the invention of printing?

6. Who was the first bookseller that was not also a printer?

8. Name some of the cities which are centres of the book trade in Europe?

9, 10, 11, 12. What is said of the *trade sales* in the United States?

13. What is said of the sale of books by auction to miscellaneous collections of people?

14, 15, 16. What is said of the sale of books by travelling agents? and also by country merchants?

THE ARCHITECT.

1. What is the general sense of the word *architecture*?

2. Why may we suppose that architecture was brought to considerable perfection before the flood?

3. From what circumstances originated the different styles of building?

5, 6, 7, 8, 9, 10, 11, 12. What is said of the *foundation*, the *column* or *pillar*, the *wall*, the *lintel*, the *arch*, the *vault*, the *dome* or *cupola*, and the *roof*?

14. Name the different styles of building which have been recognized in modern times.

15, 16, 17. What is said of the *Egyptian*, *Chinese*, and *Grecian* styles of building?

18. What is meant by the orders of architecture?

19, 20, 21. What is said of the three Grecian orders?

23. What is said of the general form of the Grecian temples?

24. When was Grecian architecture at its greatest perfection?

25. What is said of the *Roman* style? and what of the Tuscan and Composite orders?

26. What is said of the temples of the Romans?

27, 28. What is said of the *Greco-Gothic* and *Saracenic* styles?

29. Why was the term *Gothic* applied to the edifices of the middle ages?

30. What are the characteristics of this style?

31. What is the form of the ecclesiastical edifices of this style of building?

32. What is meant by each of the following words—*steeple*, *tower*, *spire*, *lantern*, *turret*, *buttress*, *pinnacle*, *parapet*, and *battlement*?

34. What particular styles are now chiefly employed?

THE CARPENTER.

1. What is the business of the carpenter?

2. What is said of the joiner?

3. What is said of the subserviency of carpentry and joinery to the professional architect?

4. What is said of contracts for the erection of buildings?

6. By what are the carpenter and joiner guided in the performance of their work?

7. Name the principal tools with which these artisans operate.

8. What kinds of timber are used for building in the U. States?

9, 10, 11. What is said of the lumbering business?

THE STONE-MASON, THE BRICKLAYER, &c.

THE MASON.

1. What does the art of masonry include?

2. Name the stones most used in building in the United States.

3. What is the particular business of the quarryman?

4. By what means are the blocks of stone divided, and reduced to form?

5, 6. By what means, and in what manner, are the stones polished?

8. From what source does the stone-cutter derive a great proportion of his profits?

THE STONE MASON.

1. Where do the stone-cutters set their own work?

3, 4. What is the composition of the mortars used in laying marble?

6. What is said of lime?

7, 8, 9. What is said of masonry required in situations under water?

10. What is said of the walls of buildings in the construction of which costly stones are employed?

11. What instruments are employed in cutting and laying stone?

13. What was the state of this art in ancient times?

THE BRICKMAKER.

1. Of what substances is brick composed?

2. Where do we find the earliest historical notice of bricks?

3, 4. What methods of manufacturing bricks were practised in ancient times?

5. What was the size of the most common bricks employed by the Romans?

6. What is said of the great use of bricks in the United States?

7, 8. Describe the operations of making bricks.

9. What is a day's work for a gang?

11. What is said of machines for making and pressing bricks?

12. What is said of tiles?

THE BRICKLAYER.

1. What is the particular business of the bricklayer?

2, 3, 4. Describe the two methods of laying brick, mentioned in those paragraphs.

6. What is said of the invention of the chimney?

7. In what part of the house did the Romans locate the hearth or fireplace?

8. What method of heating dwellings was invented in the time of Seneca?

9. What does Hollingshead say of the age preceding that of Queen Elizabeth?

THE PLASTERER.

1. In what departments of architecture is plastering more particularly applied?

2. Of what materials is the mortar for the several coats composed?

3. What tools are used by the plasterer?

4. What is said of the use of cornices? and what of their materials, and mode of application?

5. What is said of ornaments of irregular shape?

6, 7. What is said of rough-casting?

THE SLATER.

1. For what particular property is slate stone valuable?

2, 3. Whence are obtained the slates used in the United States? and how are they prepared for application?

4. In what manner are slates applied to roofs?

5, 6. What is said of the value of slates, as compared with shingles? and what of metallic roofs?

THE PAINTER, AND THE GLAZIER.

THE HOUSE AND SIGN PAINTER.

1. To what does house and sign painting relate?

2. Name some of the substances employed by this artist.

3, 4, 5. In what manner is the nufacture of white lead and parge conducted?

.6. What is said of Spanish own, yellow ochre, terra di nna, red ochre, and chrome llow?

7, 8, 9. What is said [illegible]

, and spirits of

10. What is

ation of pain

11. What is said of mixing colours for use?

12, 13. What particulars are stated in regard to the execution of house painting?

14, 15. What is meant by *graining*? and what by *ornamental painting*?

17. What is said of painting and lettering signs?

THE GLAZIER.

1. Describe the operation of fitting and confining panes to window sashes.

3. By what means, and in what manner, are panes cut to any proposed size?

4. What is said of the windows in the houses of oriental countries?

5. What substances were used for windows by the Romans?

6. What statement is made by Gregory of Tours, with regard to the employment of glass windows?

7. What does Æneas Sylvius say of glass windows in Vienna, in 1458?

8, 9, 10. What is said of coloured glass? and what of painting on glass?

THE TURNER.

1. What is said of the extensive application of this art?

2. In what kind of an apparatus is turning performed?

3, 4. How is the wood fastened in the lathe in the different kinds of turning?

5. What instruments are used in turning wood? and in what manner are they employed?

6. What is said of the *grooving tool?* and what of instruments for turning metals?

7. What is said of the *calipers?*

8. In turning different substances, what particular thing is to be especially regarded?

9. What is said of the perfection and accuracy of this art?

10. What is said of the antiquity of the lathe?

THE CABINET-MAKER, AND THE UPHOLSTERER.

THE CABINET-MAKER.

1. What is the business of the cabinet-maker?

2, 3. What qualifications are required to make a finished cabinet-maker?

4. What is said of the changes continually taking place in the form and construction of furniture?

5. What kinds of wood are most frequently employed by the cabinet-maker?

6, 7. What circumstances led to the introduction of mahogany as a material for cabinet ware?

9, 10, 11, 12, 13. Describe the process of constructig a bureau.

14, 15. With what substances, and in what manner, is the bureau varnished and polished?

17. By what means, and in what manner, are logs of mahogany sawn into thin pieces for veneering?

18. What is said of the different kinds of mahogany?

THE UPHOLSTERER.

1. What is the business of the upholsterer?

2, 3, 4. Of what materials are beds and mattresses composed?

5. What is the best material for mattresses?

6. Of what use is drawing in this business?

7. Who are the principal operators in this business?

8. What is said of the skins of beasts as applied for beds?

9. What was the first advancement from the use of skins?

10. What kind of beds did the Romans use?

11. When did the Romans adopt the eastern custom of reclining at their meals?

12, 13, 14. What particulars are stated regarding this custom?

15. What is said of the origin, use, and manufacture of carpets?

THE CHAIR-MAKER.

1. What is said of the use of the chair by the nations of antiquity?

2, 3. What is said of the seats used by the barbarous conquerors of the Roman empire?

4. What is said of our old-fashioned chair?

5. Where was the Windsor chair first used? and what was its original construction?

6. Whence do the chair-makers obtain their stuff?

7. Describe the Windsor chair.

8. Describe the process of its construction.

9, 10. Describe the process of finishing and ornamenting chairs.

11. What is said of other kinds of chairs made by the common chair-maker?

12. What is said of the manufacture of mahogany chairs?

THE CARVER, AND THE GILDER.

THE CARVER.

1. What is meant by *carving?*

2. What is said of the antiquity of carving in wood?

3. What is said of the application of this art?

4. What is said of the style of Louis the Fourteenth?

5. In what manner is carving executed?

6 What are the particular qualifications necessary to make a finished carver?

THE GILDER.

1. What is said of the union of the two employments, carving and gilding?

2. For what purposes is gilding most frequently employed? and in what does the process consist?

3, 4. Describe the process of preparing the surface for the application of the metal.

5. With what instrument is the gold leaf applied? What is meant by gilding in oil?

6. How are the ornaments on the frames produced?